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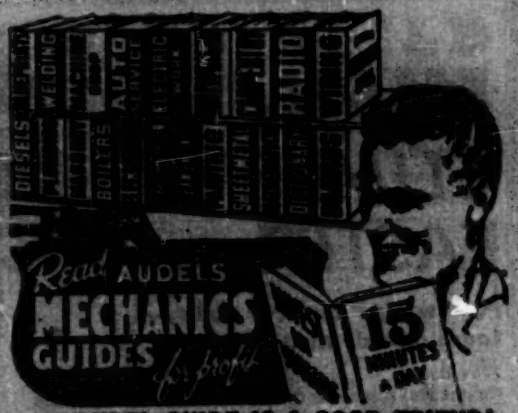

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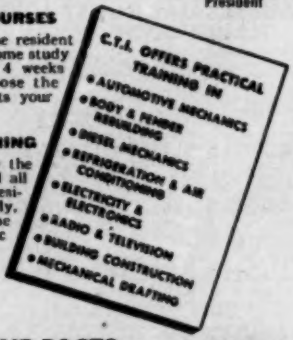

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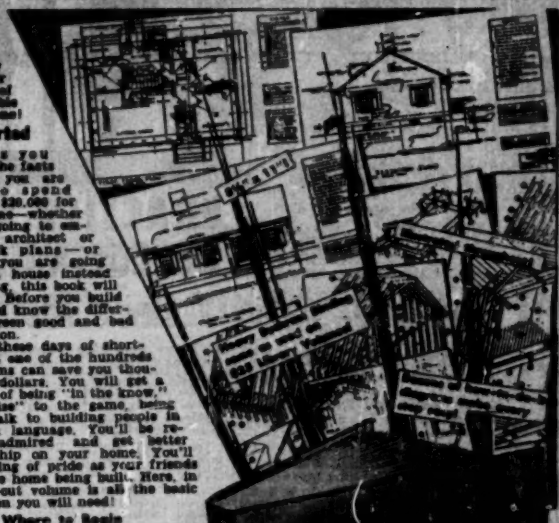

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I Trained These Men

M. JOSEPH, Sacramento, Calif., says, "Before ... ing your course ... $10 a week in ... After graduati... manager of st...

V. MARCHESA ... phia, Pa., write... lishing my N.R... have been busy ... pairing and in ... vision."

S. W. DINWIDDIE ... ville, Ill., writes, "S... finishing course, wo... servicing shop. No... Engineer of WCUN ... Police Radio Instal...

A. HERR, New C... Pa., writes, "Have ... doubled my salary ... ing in Radio full time. Am employed by Station WKBO as transmitter operator. Future looks bright to me."

L. M. HAUGER, San Bruno, Calif., tells us that "N.R.I. helped qualify me for job as Radio Mechanic with United Airlines. Have my Radiotelephone 2nd Class License."

L. ARNOLD, Pontiac, Mich., says, "While learning, I made from $5 to $10 a week in spare time. Now I am earning as high as $25 a week in my own spare time shop!"

M. LINDEMUTH, Ft. Wayne, Ind., writes, "When I started N.R.I. Course, didn't know a condenser from a resistor . . . but was soon averaging over $9 a week in my spare time."

H. B. MILLS, Washington, Ohio, finds, "Word traveled fast in regard to my N.R.I. training. Have been doing Television installation and servicing, tracing out and eliminating interference, etc."

C. STAETH, Fort Madison, Iowa, informs us, "Do Radio Servicing full time in my own shop and am making more money than ever before. I owe this to N.R.I."

T. S. NORTON, Hamilton, Ohio, says, "My first job was obtained for me by your Graduate Service Department. Am now Chief Engineer, Station WQOX."

W. R. NIC... writes fro... ...g in ... ...trol ..."

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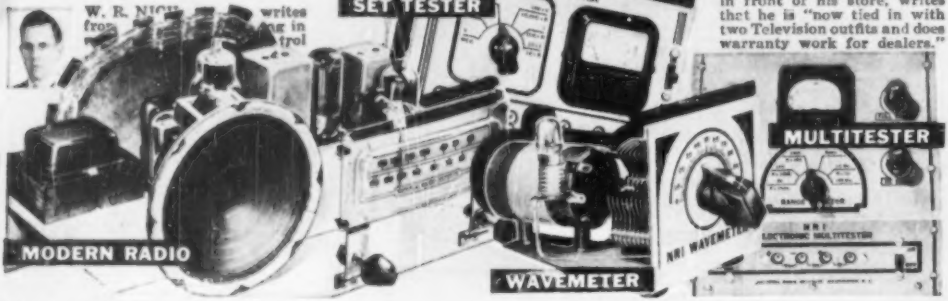
Many N.R.I.-trained men each year start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Robert Dohmen, of New Prague, Minn., shown above standing in front of his store, writes that he is "now tied in with two Television outfits and does warranty work for dealers."



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In 1945, there were 943 Radio Stations. Today, about 2700 are on the air! RESULT—THOUSANDS OF QUALIFIED MEN STEPPED INTO GOOD JOBS. Another example—only 19 Television Stations were on the air in 1947. Today, more than fifty. Within a few months, 150, say the experts—and 1000 within three years. Then add developments in FM, Two-Way Radio, Police, Marine, Aviation, Microwave Relay Radio. Think what this means! New jobs, more jobs for qualified men. The man who prepares NOW can reap rich rewards in this changing, developing, fast growing field!

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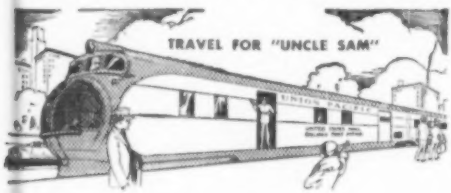

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Letters

PS Scoops Textbooks

Sir:

May I ask when the name of element No. 61, illinium, was changed to "prometheum," as given on p. 143 of PS for October? Element No. 61 was discovered at the University of Illinois in 1926 and so received its name. Students of physics and chemistry who matriculated a few years ago may have to learn all over again to satisfy some screwy professor of physics.

RUFUS G. JONES

Riverside, Calif.

On Sept. 6, 1949, the International Union of Chemistry officially recognized claims of J. A. Marinsky and L. E. Glendenin to discovery of element 61 at Clinton National Laboratory, Oak Ridge, Tenn. It did so by adopting their proposed name "prometheum" (now revised in spelling to "promethium") and symbol Pm. This action had been generally anticipated at the time the PS article went to press. Earlier claims to discovery of element 61—including those of Hopkins, Yntema, and Harris, who gave it the name illinium—now are held to have been based on insufficient evidence.

Duesenberg vs. Studebaker

Sir:

The more I read of the letter from Mr. O. Lee Gordon in your November issue [p. 8], criticizing the styling of the postwar cars, the more provoked I became. I'll admit the old Duesenberg and Cord were fine cars; but has Mr. Gordon compared their oil and gas consumption with that of the new cars?

Styles in all things will change as time goes on; so what is wrong with the style of cars changing? The public must like the new ones or it wouldn't buy so many.

WARREN NORCROSS

Philadelphia, Pa.

Sir:

Congratulations to O. Lee Gordon. It's about time somebody told off the car designers. They've gone too far, especially with the 1950 Studebaker. The majestic Mercedes-Benz and Duesenberg roadster pictured

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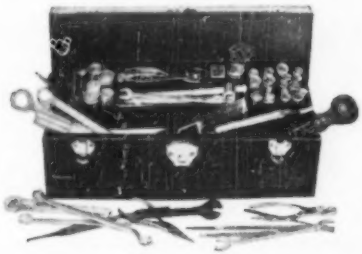

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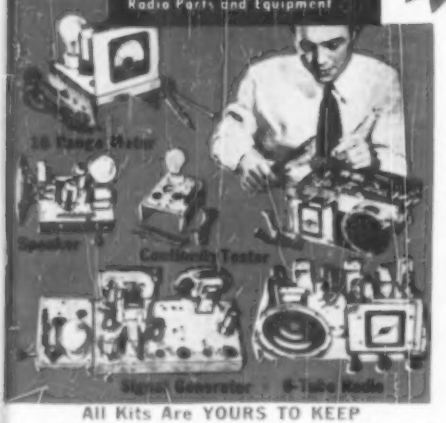

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CALVIN SKINNER of New Orleans, La. tells us he makes $5 to $10 in spare time repairing radios. He is now also working with a Television set.

LOREN D. SAUCIER of Coloma, Mich. reports that my training has made it possible for him to repair large numbers of Radio and Television sets.

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You couldn't pick a better time to get into Radio-Television and Electronics. New Television stations are going on the air to serve every major city—hundreds of new AM and FM Radio broadcasting stations are also on the air. All this creates new and bigger opportunities for the trained man who knows Radio-Television and Electronics.

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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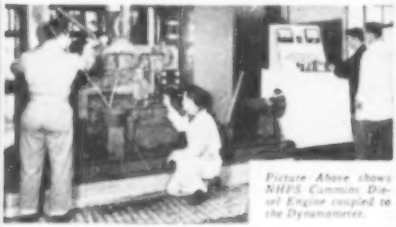

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in your article, "Good Cars Never Die" (Nov., p. 182), makes one realize this. Let's hope the designers really got an eyeful.

BYRON P. BISHOP

Honesdale, Pa.

Sir:

Please tell Mr. Gordon that what he said about the new Studebaker being a cheap sensation really made me laugh. The Duesenberg and Cord were good enough looking in their day, but now they remind me only of stripped-down battle tanks.

A. JOSEPH SHAY

Brooklyn, N. Y.

Sir:

I agree entirely with Mr. Gordon. The new models lower the standards of an American institution. The only exception in recent production is the Lincoln Continental.

J. BARAKAT

Guayaquil, Ecuador

Keep Looking

Sir:

Your "PS Last minute news & notes . . ." for November [p. 304] is much appreciated —especially the paragraph, "You'll live longer than your father . . ."

My father was 92 on Nov. 18; so I am going to look forward to the 110 mark.

PAUL V. BRETZ

St. Paul, Minn.

You can look . . . and look both ways crossing streets and airports!

Point for Rowboaters

Sir:

I have one point to add to your instructions for repairing a rowboat [Nov., p. 218]. That is to leave a space of about two inches or more between the back seat and the transom. Then any oil or gasoline that drips from the motor won't drip on the seat.

ARDEN K. HAYNES

Piseco, N. Y.

Advice to Editors

Sir:

I wish to second the remarks of Robert E. Zraik (Oct., p. 12) to the effect that PS virtually ignores all but the mechanical aspects

INVENTORS

Patent laws encourage the development of inventions.

We recommend that an inventor employ a registered Patent Attorney or agent, if the inventor is not familiar with patent matters. This is because the value of a patent depends largely upon the skillful preparation of the specification and claims in the patent application.

The firm of McMorrow, Berman and Davidson is registered to practice before the United States Patent Office. Additionally it engages patent attorneys able to readily understand inventors' disclosures, to advise concerning patentability, and to prepare appropriate specifications and claims.

If an inventor believes he has an invention, a search of the most pertinent prior U. S. patents should be made and a report obtained relative to its patentability. Where such report indicates that the invention appears patentable, in order to secure protection, diligence should be exercised in making application for a patent.

Send for a copy of Patent Booklet entitled "How To Protect Your Invention." This booklet contains information on patent protection and procedure. You will also receive an "Invention Record" blank. This will be promptly forwarded to you upon request—no obligation.

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of science. I feel that you are passing up a mine of rich material.

For instance, there are many phases of biological science that you could handle with wonderful effect. Imagine what feature writers and your splendid illustrators could do with subjects like "The Body Machine," "The Kidney Filter," "The Heart Pump," "The Brain Exchange."

R. J. MACDONALD

Vancouver, British Columbia, Canada

Sir:

Your magazine is doing a fine job in providing articles that save time and money for a man working around the house.

T. H. JENKINS, JR.

Atlanta, Ga.

Sir:

Been reading Pop Science since 1926 and keep all my old copies for reference. Have saved plenty of money on repairs to my '37 Plymouth by following Gus and Joe. Your magazine has many articles about things that a common working man can afford to make.

HENRY F. EDWARDS

Hamilton, O.

Artistic Perch

Sir:

That carved wooden perch of Mr. Fitz-Gerald's on p. 235 of your October issue is the funniest looking perch I ever saw. What he has made could be a flounder, sunfish, blue gill, crappie, or bass—but NOT a perch, unless Missouri perch are awfully different from New England perch.

AL GINGRAS

Baldwinsville, Mass.

Craftsman Fitz-Gerald is a commercial artist and perhaps entitled to exercise a bit of artistic license. He calls it a perch.

Target for Scoffers

Sir:

I'd like to see them make a six-wheel car with the engine in the rear.

It would be a safer car, for it would have six brakes instead of four. Power on four rear wheels instead of two would give better traction on wet roads, ice and snow, and poor rural roads. Reduced road impact of the rear tires over uneven terrain would be worth the small extra cost.

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Unless an inventor is thoroughly familiar with such matters, he is advised to employ a competent registered patent attorney or registered patent agent, as the value of patents depends largely upon the skillful preparation of the specification and claims.

This firm is registered to practice before the U. S. Patent Office and is available to assist inventors in the preparation and prosecution of their cases. Detailed information and the preliminary steps to take to obtain patent protection will be furnished upon request.

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Many people may scoff at this idea, but I remember that the public laughed when four-wheel brakes were first introduced. . . .

GRAYDON H. HARRIS

Greenbelt, Md.

"More Power" to Gar Wood

Sir:

Your article on Gar Wood's sea speeder [Nov., p. 106] says the boat has four Diesel engines totaling 1,200 hp., but the caption for the picture of the port engine room mentions her "four 1,200-hp. Diesels."

PAUL FRIES

Lorain, Ohio

Four Diesels of 1,200 hp. each is correct—a total of 4,800 hp.

Watched Watch

Sir:

Looks like your $30,000 watch (July, p. 152) should be sent back to the factory for orientation.

What year is indicated? There's been no Sunday, July 31, with an eight-day moon—as shown—since World War I.

From the various dials, it appears that the watch is made for approximately Lat. 41° N. Long. 75° W. To match the Eastern Standard Time indicated, the sidereal dial on the other face should indicate about 0600 or 1800—not 2112, as shown.

CONGDON

Bradenton, Fla.

Reader Congdon's eyes are sharper than his imagination. For photographic purposes, the watch was stopped and the various dials and hands set in positions to show the greatest amount of detail.

Missing Link Identified

Sir:

Your article "Amplifier Fits on Headphone," Oct., p. 232, told me just what I needed to know—almost—to complete the pocket radio I am building. There was just one bit of information missing: what type of tube to use.

JAMES DENNY

Hammond, Ind.

The tube to use is a 2E36—a subminiature tube of the kind used in hearing aids.

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GENERATORS
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WIRING JOBS
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(Shown at left—Instructor demonstrating latest type of Test Unit for checking the efficiency of a Motor.

AND RADIO-TELEVISION

On Real:

TELEVISION SETS
RADIO RECEIVERS
F.M. (Frequency Modulation)
RECORD CHANGERS
AUTO RADIOS
AIRPLANE RADIOS
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(Right — Instructor explaining operation of 20-inch Cathode Ray tube used in Dumont Television Set.)

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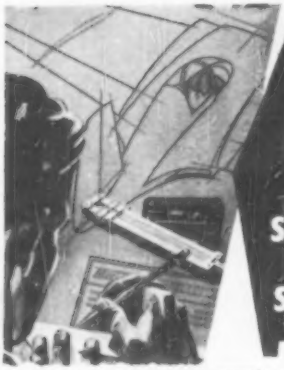

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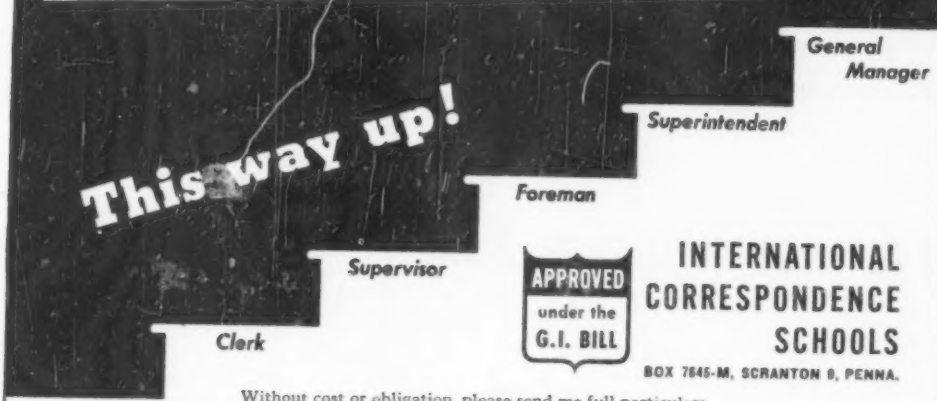

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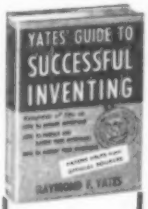

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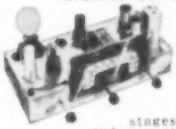

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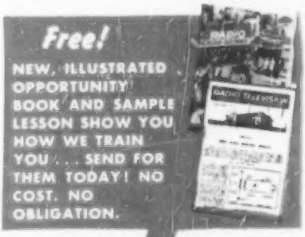

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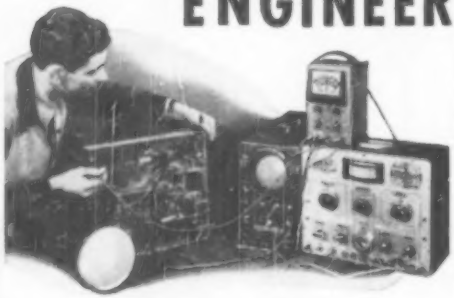

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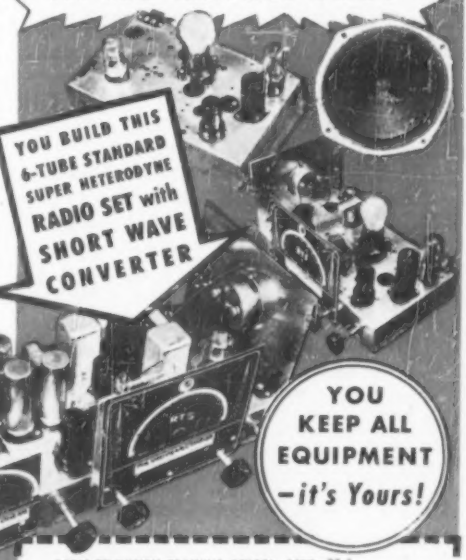

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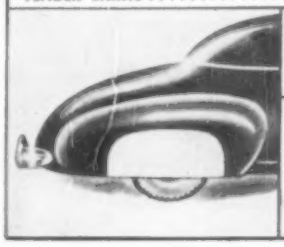

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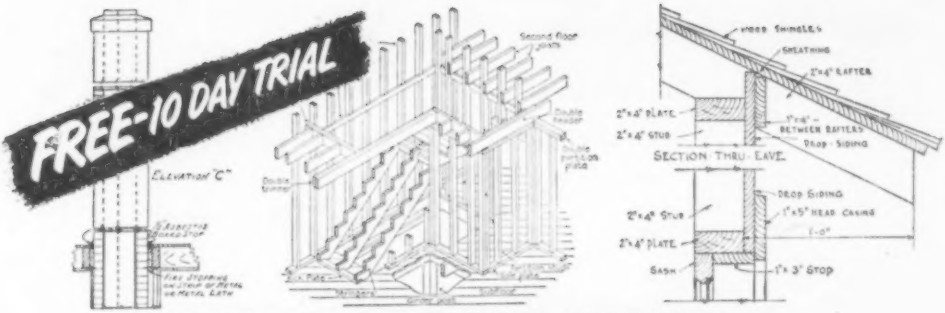

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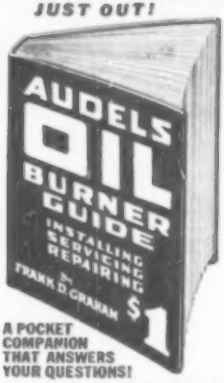

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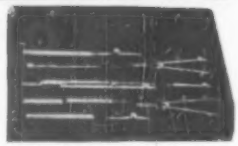

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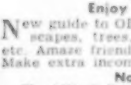

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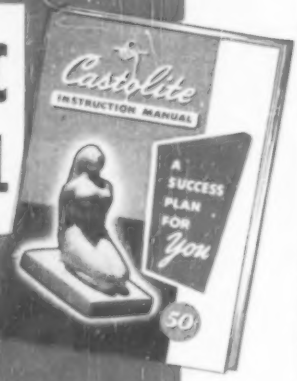

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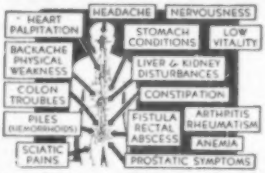

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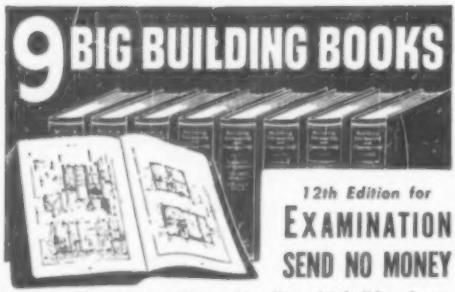

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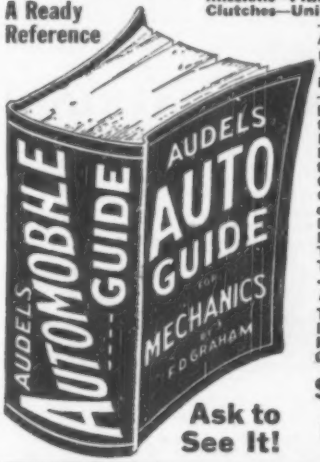

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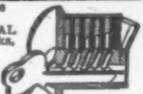

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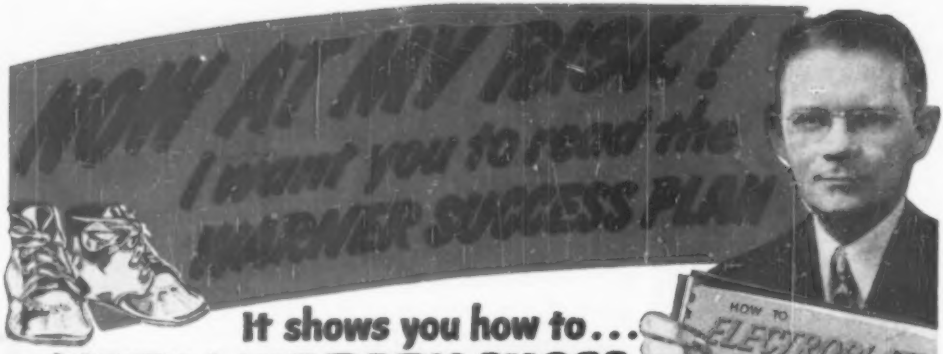

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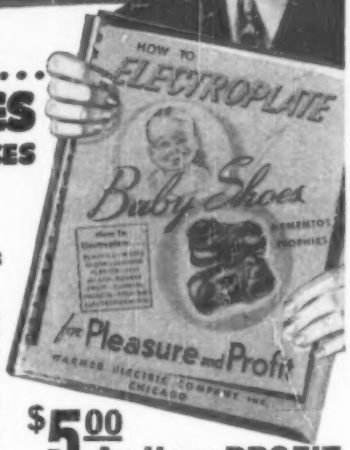

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MOLDING Rubber for Hobbyists, Industry. Classroom Projects! Flexible Molds easily made from the best Quick-Drying White Liquid Rubber! (Gallon—$7.95; Quart—$2.95; Sample Half-Pint $1.00) Prepaid Parcel Post! Plastercraft Supply Co., 3051 St. Clair Ave., Cleveland 14, Ohio.

"How to start a successful mail order Business." The guide to sound, profitable mail merchandising. 25c. Manhattan House, 126-R Lexington, New York 16.

MAKE Money spare or full time, casting Metal Toys and Novelties. Big Wholesale and chain store demand for cast Metal Autos, Soldiers, Ashtrays, Bands, etc. Keeps manufacturers busy. Production moulds furnished for up to 100 and more casting per hour. No experience or special place necessary. Write for full information and illustrations of patterns needed. Metal Cast Products Co., Dept. E, 1696 Boston Road, New York 60, N. Y.

HOW To Set Up and Run a Mirror Shop! Resilver Mirrors. Make chipped glass nameplates. Electroplating Salts and Rectifiers. John Sprinkle, V 90, Marion, Indiana.

MEN have succeeded selling shoes who believed they could not sell. Free Selling Outfit puts you in secure business. Consolidated Shoe System, Dept. 5-436, Chippewa Falls, Wis.

TRADE Magazines help you get ahead. Latest copies. More than 1100 covering every trade, business or interest available through our easy-to-get-acquainted service. Full particulars and price-list Free. Commercial Engraving Publishing Co., 34S North Ritter, Indianapolis 19, Indiana.

WEAVING moth-holes, burns, tears in wearing apparel From your own home or store. Method copyrighted. Work done by hand. $120. Amber Weaving Service, 611 Main Street, Buffalo 3, New York.

LIQUID Rubber, make flexible molds. Free Sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

COLORGLAZED Concrete Pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, Minnesota.

YOUR own profitable home business. Preserve live flowers to last forever. Spare or full time. New discovery—simple—fascinating. No experience necessary. Send $2.00 for working equipment, instructions and valuable sales plans. Satisfaction guaranteed or money refunded. Hermansen, 210 Fifth Ave., Suite 1102, New York 10, N. Y.

BIG Money—Spare or full time. Hand painting fabrics, ties, blouses, leathers, etc. is big business. New easy method. Help us fill demand. Free samples and complete plan. Hollywood Artabs, 1A 36 West Green Street, Pasadena 1, Calif.

COLLECT $300 Weekly by mail. Details. Credit Bureau, Elizabethtown, Ky.

NATURAL molding latex. Extra thick. Free sample. W. Wooley, 115-B Donald, Peoria, Illinois.

MAKE Rubber Stamps, Feather Pictures, Metallize Baby Shoes, Repair Dolls. Make plaster Novelties. Catalogue of "30 Ideas" Free. Universal, Box 1076-B, Peoria, Illinois.

MAKE durable building plastic of waste. Build Attractive home-$150.00 room. Bays Laboratory, Oklahoma City 9.

METALLIZING Baby Shoes makes you money. Free details. Joseph Kushner, Electroplating Engineer, Stroudsburg 81S, Pennsylvania.

ELECTROPLATING technicians make money! Learn easily. Details free. Joseph Kushner, Electroplating Engineer, Stroudsburg 8S, Penna.

BIG-Paying Home Mailorder Business. Details free. Jackson, Newfoundland 4, Ky.

MAKE money making new greaseless doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. S. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

GOOD Paying Business Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late methods. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. E, Decatur, Illinois.

EXTRA Money — No selling — operate vendors. Amazing profits, details Free. Silver King, Suite 282, 622 Diversey, Chicago 14.

POPULAR SCIENCE OPPORTUNITIES

OPERATE profitable mail order business. Write Walter Service, 4159-B East 112th, Cleveland 5, Ohio.

A FACTORY in your home garage! Mfg. and sales rights, mechanics' waterless hand cleaner. $500-$800 monthly. No special equipment necessary. Formula free. Western Aircraft Mfg., Dept. G, Los Angeles 9, Calif.

I MAKE big money in the mail-order business. You can do the same at home with copyrighted system. Write me. I'll tell you how. F. Little, RD # 1, Glenshaw, Pa.

MAKE money addressing envelopes. Our instructions reveal how. Glen Glenway, 5713 Euclid, Cleveland 3, Ohio.

ENVELOPES addressed accurately, reasonably. Fast Service. We have capable addressers in your city. Glenway System, 5713-Z Euclid, Cleveland 3, Ohio.

EARN Money At Home With Your Typewriter! Spare time! Details free. Edwards, Publisher, 3915-PS, 12th, Des Moines 13, Iowa.

MAKE Perfume—Simple Method. Write "International", 6347 Parnell-PS-1, Chicago 21, Illinois.

LEATHER Carving. Fascinating, highly-paid art; age-old secrets now taught by first time in home study course. For hobby, profession or profitable business, write; Baird School of Leather Carving, Box 1367-D, Manitou Springs, Colo.

HOME Envelope addressers! Latest "100 Mail Order Houses" List Ready. Price $1. Adlist, Box 443, Seattle 11, Wash.

BIG money. Spare or full time in your home. No Selling! Spray New Miracle Finishes. Plush and Suede, on signs, radios, automobiles, figurines, lamps, toys, etc. Our business is booming. Help us fill huge demand. Cash in now on Big Christmas orders. New easy Flok-Kraft methods. Material costs few pennies. You get dollars. Free samples, complete powerful money making plan free. Write now! Coast 1008 S. Los Angeles St., Los Angeles 15.

HOW and where to obtain Capital? Free details. Star Service, Wapakoneta, Ohio.

ELECTROPLATE on non-metallics. Instructions $1.00. Four ampere plater $19.95. Eight ampere $29.95. 30 ampere $85.00. Kissel Electric Products, 431 Sherman, Galion, Ohio.

WOULD you pay 3¢—first $350 made? Book "505 Odd, Successful Enterprises" free! Work home. Expect something odd! Pacific, Oceanside, Calif.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21, Piqua, Ohio.

MAKE flexible molds! Cast plaques, novelties, bookends! Free sample! H. Tooker, Hamilton 7, Ohio.

"HOW To Bronze Baby Shoes For Profit". New, Different! Book contains complete instructions for Bronzing shoes, obtaining orders. Method requires No Equipment, Capital, Experience. Make Money Immediately! $1.00 Prepaid. Metalizing Industries, Box 263, Hagerstown, Md.

MAKE Perfume. Profitable home or mailorder business. Information free, men, women write. "Carey Laboratories", 1914 Chouteau PS1, St. Louis 3, Missouri.

POPCORN Equipment, Potato Chip Outfits. Long Eakins Company, 5063 High, Springfield 99, Ohio.

QUICK Money! "Repairing Car Batteries"! At home! Easy too! Batteryman, Grand Junction, Colorado.

WILLING to work for yourself? Complete instructions for starting Successful vending business $1.00. A. Herrmann 2041 Chatterton Ave., Bronx 61, New York.

MAKE Money in Profitable Home Operated Mail Business! Thousands do. Rush name for revealing literature. Smith, Box 2592-B, Hines, Illinois.

YOUR own Plastic Business at home. Produce costume jewelry, novelties, statuettes, Liquid plastic, liquid marble. Flexible molds. Write for Free Book. American Trades, Box 1473-R, Cincinnati 1, Ohio.

MAIL Literature—Run Ads—Sell Merchandise. Books etc. Easy, Pleasant, Profitable. Everything furnished! Details free. National, Box 88-B, Dorchester 22, Mass.

TIN Cans. Turn them into cash. Nine methods. Instructions 50c. Charles, 12-FT, Norwood, Ohio.

SAWDUST. Turn it into cash. Six methods. Instructions 25c. Charles, 12-FS, Norwood, Ohio.

BOOKKEEPERS earn $100.00 week operating your "Bookkeeping Service". Simplified plan. Information free. Bookkeeping Service, Box 664-P, Springfield, Mo.

$25 WEEKLY working two hours daily. No canvassing. No Manufacturing. Lycke, Box 2471, Cleveland 12, Ohio.

LIKE to Make $20-$40 Weekly at home? Proven mailorder Plan does it. Free Details. Perry Publications, 906-B North Wenatchee, Wenatchee, Washington.

BIG Money Regraining-Refinishing Automobile Dashboards—Garnish Mouldings. Write Outman, 4323 So. 38th, St. Louis.

WHERE to buy 500,000 articles wholesale. Details free. Krueger, 3418B Wolcott, Chicago 13.

PIANO Tuning — Home Study — (15th year). Empire School, Champaign, Illinois.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write; Woodart, Bridgewater, Massachusetts.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

BUY Wholesale. Big-Name Items Up To 40% Below Retail. Folks Eagerly Buy Through You To Get Big Savings. Details Free. Young's, Kent 2, Ohio.

"MORE Money—Easier! Revolutionary methods make public bookkeeping easy, interesting, profitable. Earn to $5.00 hourly within short time! Simple, complete instructions. Full—spare time. Success-revealing information free. Auditax Systems, 10775 P Tabor, Los Angeles 64."

"MAKE extra money rainproofing Garments. Formula and instructions 50c". Cheswick Rainproof Sales, Box 232, Dept. A, Cheswick, Penna.

METALLIZE Baby Shoes. Excellent profits. New system assures success. Free details. Treasures Forever, 38 Michigan Ave., Lynn, Mass.

AMAZING new book "The Real Truth About The Mail Order Business" exposes the crooks, the petty schemes, tells you how to start. Free information. Ralph A. Long, 208 West Broad Street, Tamaqua 8, Penna.

BABY Shoe Metallizing. Modern, Simplified, Practical system. Schoettle, Friendship 4, Ohio.

OWN Your Mail-Order Business envelopes, bags wholesale. Good profits. Omaha Envelope, 4721-G California, Omaha 3, Nebraska.

"MINIATURE Golf"—complete plans, specifications, $25.00. Reference—Eastern Golf Co. Fred Salonen, 61 Berdan St., Rochelle Park, N. J.

$92.50 STARTS you in fascinating motion pictures as owner-operator-exhibitor. Make to $50 day. Studio, 5259 Hollywood Blvd., Hollywood 27, California.

57 MONEY MAKING OPPORTUNITIES

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner, P-125, West 86th, N. Y., N. Y.

SCHOOL Seniors—Earn 40% commission selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm Street, Scranton 5, Pa.

WANT Notary Public appointment? Official in usually 10 days. Stationers Exchange, Boerne 50, Texas.

$20.00-$100.00 Daily. Clean Furnaces. Make Money like I do. Plans & Instructions $1.00. Furnace Man, Box 327, Seneca, Illinois.

SEWING Machine Business Tops. Big money—not crowded. Spare time home set-up. Repair course, new machines, motors, etc., wholesale. Hurry. Taylor Service, PS, Hamilton, Ohio.

BIG Money! Learn Watch-Clock Repairing at home. Free information. Modern Technical Supply, 55B West 42nd St., N. Y. C. 18.

WE Want to Buy a Product We Can Sell by Mail. Do you have a new or unusual product, or an idea for such a product, that we can sell by mail? If so, this established, reliable firm in Greater Kansas City is ready to talk business with you. Here's your opportunity to make money. Send complete details about your product, or idea, to Dept. B, Special Order Service, Box 164, Kansas City, Kansas. Write Today!

RAISE Ginseng. Roots Bring Fortunes. Circular. Fezler Seed Company, Patchogue, New York.

BE a Cartoonist. A Fortune may await you. Write for free circular. Chas. J. Sprusil, 97-42 43 Ave., Corona, L. I., N.Y.

NEW way. Earn $50 weekly working at home. We show you how. Ability in simple arithmetic essential. Send 25c coin (no stamps) for details. Dollar-a-Month Plan, Box 5236-B, Phila. 26, Pa.

WIN Contest Money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

"TEXBURGER." The Sandwich that is different, fast, profitable and repeat seller wherever introduced. Write today for free literature. Haskell D. Boyer, P. O. Box 1486, Fort Worth 1, Texas.

ELECTRICALLY Inclined? Make $100-$250 weekly installing, maintaining fluorescent lighting. Rebuild fixtures. Make beautiful lights for 50c each. Establish own Sales Service & Fixture Fixit Shop. Exclusive, inexpensive, illustrated instructions with free sample materials enables you to cash in on this fast-growing industry. Get the facts. Request impressive evidence and convincing free literature on this proven business opportunity. Wilbur Distin "Fluorescent," 401 Foote Bldg., Syracuse 2, N. Y.

EARN Money Evenings copying and duplicating comic cartoons for advertisers. Adservice, Argyle (2), Wisconsin.

MAKE money at home in spare time. Raise Golden Hamsters. Small investment. Literature free. Golden Gate Hamstery, 631-G Richmond Street, El Cerrito, Calif.

WOULD You pay 3¢—first $350 made? Book "505 Odd, Successful Enterprises" free. Expect something odd! Pacific, Oceanside, Calif.

DELIGHTFUL Plans! Australia, South American. Free Book "372 Unusual Worldwide Business." $800.00 month reported. Work home (U. S. A.)! Get surprise! Publishers-9H, Carlsbad, Calif.

MEN-Women—"Everybody Likes Candy." Learn to make professionally at home. Instructions and Outfit. Details free. (Our 39th year.) Ragsdale Candies, D10 East Orange, New Jersey.

FAST Seller—100% Profit. Sell our book 'Be a Photographers Model in 10 days'. Sample 50 cents. Schick Publishing Co., 631 Third Ave., N. Y. C.

OPERATE profitable mailing bureau. Complete instructions — 25c. Imperial, Dept. PS-1, Wilmington, N. Car.

"URANIUM—is currently the world's most-prized material. Full particulars Free. Write Sharpe, Prospector, Box 142, North Battleford, Canada."

$500 earned with plan #1 entitles you to work on our 2nd plan. To start now send $1. B. Wyckoff, 11 West 42, N. Y. C.

CLEAR up to $10,000 yearly. Small investment weekly; No work. Simple. Legitimate. Full particulars $1.00. Box 225, Manhattan, Kansas.

MILLION Articles Wholesale. Directory 25c (refundable). Publisher's, Box 1302, Detroit 31.

HOSPITAL attendant, mental, Psychiatric Aides. Opportunity for one only, each hospital to make spare time dollars every day among your fellows. Write fully. Professional Association, Northport 351, New York.

SEND Postcard for "1001 Ways to Make Money" 1001 Opportunities Club, Dept. "S", 1495 Westchester Ave., New York 59.

POPULAR SCIENCE OPPORTUNITIES

58 FORMULAS, PLANS, ETC.

10,000 FORMULAS and trade secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

FREE Formula Catalog anything analyzed $20.00. Western Chemical, Salem, Ore.

SHOPOWNERS, convert store—burn crankcase oil—new efficient burner—Plans $1.00. Unger Service, 1001 San Juan, La Junta, Colorado.

59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics, 2433 Lincoln Avenue, Alameda, California.

INTERNAL Carvers—guaranteed fast cutting, high speed, tapered drills with sharp points that make carving easier. 1/16", 3/32"—$.80; 1/8"—$1.00 each postpaid. Send for literature. Bay Sales, 101 Fifth Ave., N. Y. 3, N. Y.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", 86c; 1/8", $1.25; 3/16", $1.52; 1/4", $1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, N. Y.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook, New Jersey.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Sew, drill, carve. Complete kit only $3.95 postpaid, or send 25c for exciting new home project manual showing how to get started. Castolite, Dept. A102, Woodstock, Illinois.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

MAGNIFICENTLY carved plexiglas wall plaques 2½" x 7¼" $3.39 pair postpaid. Free plastics Supplies Catalogue. Craft Plastics, Somerville, New Jersey.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop, 309 Cowardin Ave., Richmond, Virginia.

WHOLESALE Plastics supply catalog, 10c. Lucite, clear, colored. Metallic Acetate, 15 colors. Thick Lucite cutoffs, polished blanks for carving. Metal findings, tools. Ideas, bargains galore. Quantity prices on Casting Plastic. Gem-O'-Lite, Box 685Y, North Hollywood, Calif.

ATTENTION! Internal carving Drills. High Speed Steel. Professional type Double spiral, hand finished, 3/32" or 1/8" $75 each postpaid. Plasticrafter's, Box 68, Ft. Hamilton Station, Brooklyn 9, N. Y.

60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting, Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N. Y.

USEFUL Laboratory Item. Catalog of Chemicals, Laboratory Apparatus, Kits, 10c. Rex Laboratories, 2849-B Birchwood, Chicago 45, Illinois.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26. Biological Supply Co., 1178 Mt. Hope Ave., Rochester 7, N. Y.

NEW catalog: Chemistry, mineralogy, biology, physics 10c. Tracey Laboratories, Evanston, Ill.

NEW, Used Catalog 10c refundable. Atlantic Laboratory Supply, 21 Wenham, Boston JP, Mass.

61 HELP WANTED

FOREIGN Employment?? List of Overseas projects with application form. $1.00 Cash (C.O.D. $1.32). Foreign Service Institute, Box 3980, Miami 24-A, Florida.

IMMEDIATE opening for reliable man with car to call on farmers. No experience necessary. $15 to $20 in a day. Permanent. McNess Company, Dept. 214, Freeport, Ill.

FOREIGN Employment. Construction men, building trades mechanics, helpers, office men. Good workers needed for oil projects, mining, pipe lines, dams, power plants, roadways, shipping, etc. Transportation and quarters furnished; high wages. Listings of firms actively working and hiring on projects in South America, Arabia, Asia, Africa, Alaska, Central American, etc. Send $1.00 for foreign construction compendium and application forms. Foreign Service Bureau, Dept. PS-1 Employment) P. O. Box 295, Metuchen, New Jersey.

INTERESTED in Latin American and Foreign Employment???? $1.00 Brings 1950 Copyrighted "Foreign Service Directory" with new complete listings in US & Canada in Construction Companies; World-wide Oil Firms, Mining, Aviation, Steamship, Transportation; Manufacturers; Importers & Exporters; Domestic & Foreign Listings. Special Daily Listing of firms hiring. Tells How-When-Where to apply, application form. Global Reports, P. O. Box 883-S, Hollywood 28, Calif.

ALASKA—The Great American Frontier offers unlimited opportunities. $1.00 brings 1950 Copyrighted Report & Government Map. Business Directory listing Big Construction Projects; Fishing; Mining; Aviation; Hunting—Fishing-Game rules, Fur-Farming, Lumber; Agriculture; Live Stock Raising; Transportation; Homestead & Highway information. Hot list of firms hiring. Alaska Opportunist, P. O. Box 883-S, Hollywood 28, Calif.

JOB Opportunities, California, Florida, Anywhere, U.S.A. Vacancies many trades, professions. Housing, cost-of-living information. Free particulars. Business Press Services, Baldwinsville, N. Y.

SPECIAL Pleasant Work at Home. Demonstrate new table cloth. Take orders. Good earnings. Send no money. Styleco, Dept. 65, Cincinnati 10, Ohio.

62 AGENTS WANTED

PHOTO-Salesmen-Agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least $5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PS, 308 Canal St., New York 13, N. Y.

BE Renewal Headquarters for all magazines. Big profit in Christmas gift sales now. No experience—No capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 510A, Mount Morris, Illinois.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics, Dept. A-1, 3936 Market St., Phila. 4, Pa.

FAST profits—No investment. Send for big free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Company, Dept. F1, 347 Broadway, Passaic, N. J.

DRESSES 18c; Men's Overcoats $1.00; Skirts 50c. Free Catalog. Crown, 164-PS Monroe St., New York 2.

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, tie holders, complete line Police and Firemen's Badges. 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties, Box 1425, Dept. 7, Providence, R. I. Established 1926.

WHERE To Buy 800,000 articles direct from Manufacturers. Save by buying direct. Sent Free. "Your Profits Under the Spotlight." Glass Pub. Co., Ellwood City 3, Pennsylvania.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-119, 7536 Greenwood, Chicago.

FREE Nylons given if Kendex hosiery runs or snags. World's only women's hosiery sold with written guarantee amazing everybody. Mere words could not express unbelievable money making opportunity. Fantastic earnings become reality. Armstrong earned $202 in 9 days. Watkins sent 92 orders in one day. Imagine replacing hosiery free regardless of cause—whether use or abuse! Truly sales dynamite for terrific profits. Even if you never sold before, three magic words: "Guaranteed Against Everything" will open doors for you—make women listen and pour money in your pocket. Nationally advertised in Life, Ladies Home Journal, Saturday Evening Post, McCall's and Woman's Home Companion. Awarded Seal of Approval by Good Housekeeping. 75 million readers will see Kendex advertising to help you make quick sales and big money. Complete line from sheerest 15 denier 51 gauge to heavy 70 denier service. Sizes 8½ to 11½; lengths 28 to 35 inches; latest fashion colors plus white; full fashioned seamed and seamless. No competition because Kendex nylons are not sold in stores. Also complete line men's hosiery actually guaranteed for one full year or replaced free. Nothing like this anywhere. Includes rayon, nylon, lisle, wool, cotton, mixtures, etc. All styles, patterns, colors, prices to please everybody. 200,000 pairs constantly in stock for fast delivery. Thousands shipped daily. Over 30 years in business. You need no money or experience. Nothing to pay now or later. Just show free outfits. Write orders. We deliver and collect. Big advance cash plus huge bonus. Earn money spare or full time—exclusively or as side line. No restrictions. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman, young or old, experienced or beginner, you can make money and friends writing orders. Everything you need is furnished free, including sales books in color, samples of hosiery materials etc. Simply write your name and address on postcard and make money next week with money-making outfits sent free and prepaid. No obligation. Kendex Company, Babylon 24, New York.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

MAKE Money Fast. Sell gorgeous, new Metal and $1 Plastic Greeting card assortments, 100 other sell-on-sight items. 21 All-Occasion cards for $1.00. Birthday, Easter, Relative cards, Wrappings, Scented Stationery, Gifts. Amazing profits. Bargain offers. Write for Samples on approval. Hedenkamp, Dept. PS-3, 361 Broadway, New York.

AMAZING Offer—$40 is yours for selling only 50 boxes. Also entirely different, new Deluxe All-Occasion assortment with television card. Little Pearls, Hankie Gift Greetings, other surprise items. Feature boxes on approval. Free samples imprinted stationery and Rose Scented Notes. Write today. It costs nothing to try. Cheerful Card Co., 1089, White Plains, N. Y.

BETTER way to extra money! Sell outstanding new Plastic, Metallic greeting cards, Gift Wrappings, Scented Stationery. Profits to 100%. Bonus. Request free samples exclusive Name Imprinted and Floral Stationery. Free catalog and Feature All-Occasion samples on approval. Special offers. New England Art Publishers, North Abington 201, Mass.

NEW "Sponge" Wall Cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 141, Akron, Ohio.

START the New Year right selling Cell-U-Mop, the finest DuPont Cellulose Sponge (Not rubber) mop on the market. Exclusive patented construction; ideal for every cleaning, waxing purpose in homes, business places, institutions. Quick, easy sales; big profits. Amazing opportunity for full or part time business of your own. Write today! Cell-U-Mop Co., Dept. PS-1, Freeport, Illinois.

SELL, ultra-blue stock signs to stores, 1000 slogans, comedy, general, religious. "7x11" cost 6c—Sells 35c—Make money. 15 samples. Ultra-blue signs "7x11"—$1.00 postpaid. L. Lowy, 8 West Broadway, Dept. 518, New York City.

POPULAR SCIENCE OPPORTUNITIES

"NO-FOG" Windshield Cloth. Instantly removes blurry Mist, Frost, Sleet, Snow. Stops windshield fogging. Samples sent on trial. Kristee 142 Akron, Ohio.

MORE Money, selling Sunshine's everyday Greetings, Little Dutch Garden, 21 Millinery Fashion Notes, value-packed 48 Sunshine Notes, beautiful pastelle Suede plus birthdays, sympathy, plastics, children's gift wrap, imprinted stationery and napkins. Outstanding values, profits. Write today. Samples on approval. The Sunshine Art Studios, 115 Fulton St., Dept. PS-1, New York 8, N. Y.

FREE Samples, and amazing plan, giving you Gorgeous Dress without penny cost. Rush name today with dress size. Harford, Dept. B-235, Cincinnati 25, Ohio.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5278, Cincinnati 3, Ohio.

MAKE Money Calling on Friends. Show nationally advertised Greeting Card Assortments—16-Card All Occasion Assortment only $1.00—also Birthday, Gift Wrapping, Plastics, Imported English Napkins, Floral Stationery, Children's Books, many more! Up to 50c profit on each assortment. Experience unnecessary. Samples on approval. Write Wallace Brown, 225 Fifth Avenue, Dept. GH 4, New York 10.

GREETING Card Moneymakers. Birthday, Valentine, Easter. Greenport Art Company, Dept. 16-C, Brooklyn 15, N. Y.

SELL Slot Machines, Games, Home Bars. Send for wholesale deal. Webb Distributing Co., 4958 West Chicago Ave., Chicago 51, Ill.

BE Renewal Headquarters for all magazines. Handle everything at home. Big profits. No experience—no capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 510A, Mount Morris, Ill.

SELL DuPont Nylon Uniforms. Complete line famous exclusive Hoover styled nylon uniforms for beauty shops, Nurses, doctors, Waitresses, others. Best quality, splendid values. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. B-101, New York 11, N.Y.

"MEXICAN feather pictures. Free details. Samples 10c stamps. Sylvia, Apartado 9036, Mexico City.

GET Rich Deal! Redybilt power mowers — $25.00. Smith Agency — 4 Excelsior Springs, Missouri.

FREE Samples. Big profits showing amazing Glow-In-The-Dark Specialties, House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save". Service Publishing, 218-B Investment Bldg., Pittsburgh 22, Pa.

GOOD Paying Business. Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures etc., by late method. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. G, Decatur, Ill.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

MORE money—so easy! Sell distinctive new greeting cards, stationery. Fast selling Plastic, Metallic, 3-dimension, 21-card $1.00 All-Occasion assortments. Profits to 100%. Exclusive Gift Wraps. Novel "double" cards. Animated Books. Gifts. Bonus. Special offers. Write for free samples exclusive Name Imprinted Decorated Stationery and feature All-Occasion samples on approval. Elmira Greeting Card Co., 2110 Elmira, New York.

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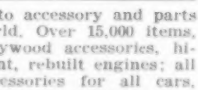

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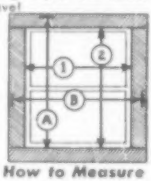

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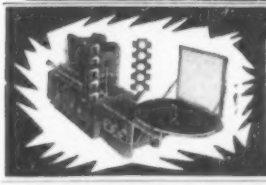

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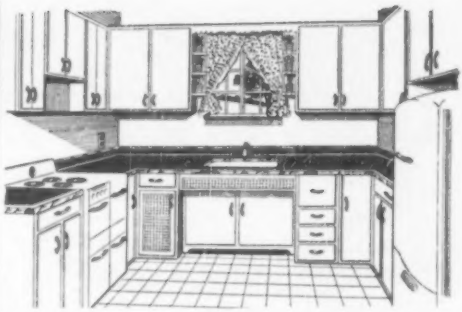

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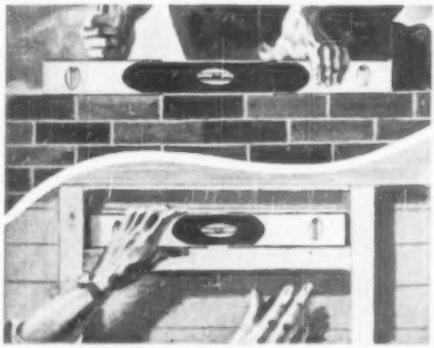
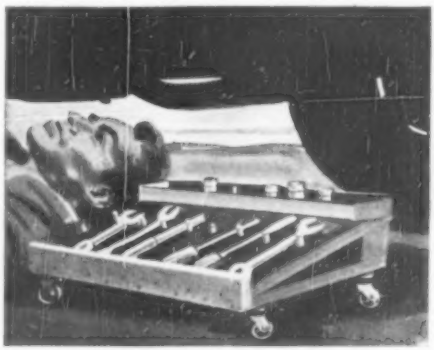


Levels with telescoping ends. These would be fine for the home owner who does occasional repairs. By pulling the ends in or out, one level would take the place of several.—*Fred J. Kost, Orlando, Fla.*



A rolling tool carrier for work under a car. It could be a low, slightly sloping board mounted on casters. Pegs would keep the tools apart. A box on top would hold sockets for a wrench.—*Richard E. Truett, Los Angeles.*

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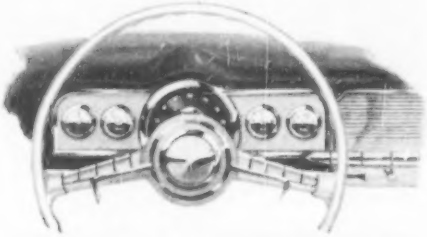
LET YOUR INSTRUMENTS MAKE YOU A BETTER DRIVER



Your instrument panel is a thing of beauty, but primarily it is a practical aid to better driving. Your instruments tell you all you need to know about the operating efficiency of your engine. Cultivate the habit of **checking them frequently.**

Oil pressure is vital. it registers the "blood pressure" of your engine. If too low, it indicates low oil level, oil too thin or oil pump inoperative. If pressure is too high, oil is stiff from cold or too heavy. In either case **it's a danger signal—heed it.**

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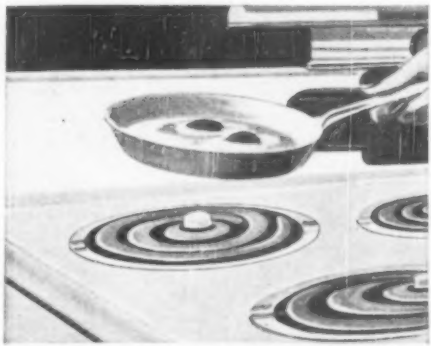
A lock-up compartment in refrigerators for medicines. It wouldn't take up much space in the refrigerator, and you could store medicines that have to be kept cool.—*Joel A. Moskowitz, The Bronx, N. Y.*



Automatic switches on each burner of an electric stove. The weight of a skillet or pan would turn on the current. Removing the pan would turn it off. You couldn't accidentally leave a burner on.—*Charles J. Hanrahan, Keene, N. H.*

Removable plates on the oil pans of cars. To clean the sludge out of the crankcase, you could just remove this plate. There would be no need to remove the entire oil pan.—*R. D. Tone, Monahans, Tex.*

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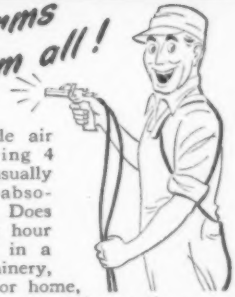

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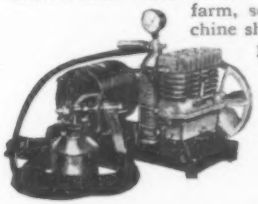

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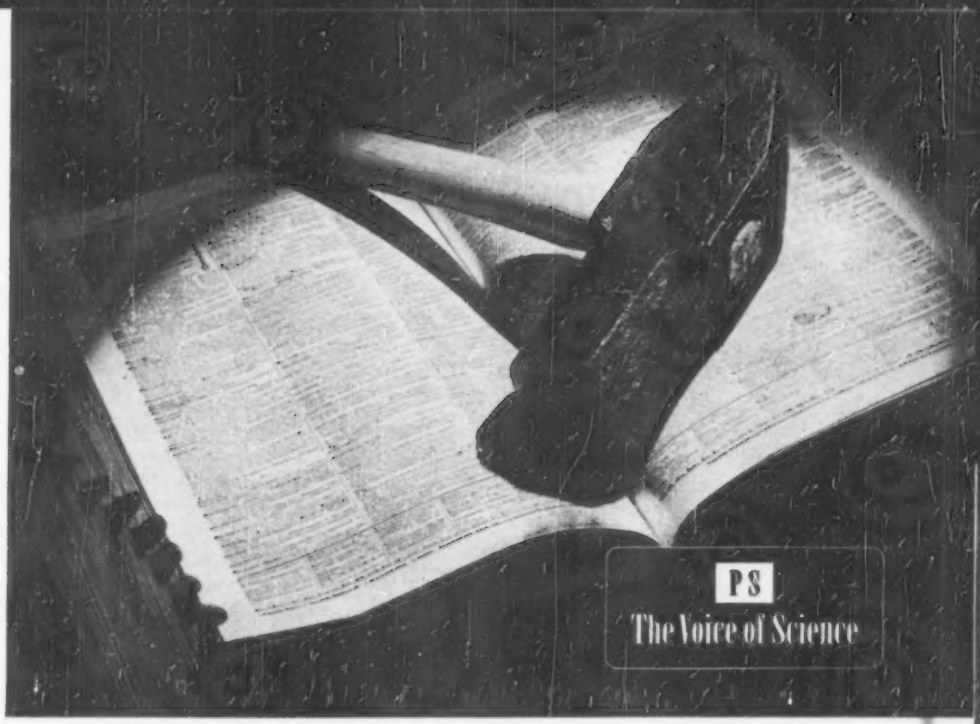

Why Every School Should Be a 'Trade School'

FOR a country so proud of its machine tools, we are pretty snobbish about our machine schools.

Sure, we have some "vocational" and "technical" high schools, as distinguished from the "classical" or academic high schools set up for a theoretical public education from cradle to college. But there are too few real trade schools. And too many of these few are locally labelled as parking lots for dopes who can't make the grades in the book schools.

This segregation is shameful because it fails to understand the difference between those who think with *words*, and those who think best with *things*. There will always be dopes—in white collars or work shirts. And there will always be those whose competence they can demonstrate better than they can describe.

But the real stupidity of this segregation of *doing* and *reading* is its failure to recognize the facts of our compulsory education system. There are vastly more desks and books in academic high schools than there are benches (or wrenches) in trade schools. Book-school courses and customs are angled for college. Yet *four out of five high-school seniors never go to college.*

This doesn't mean that their book learning is wasted. But it does mean that a great proportion of high-school seniors suddenly become freshmen as people. And some of them would be happier as trained motor mechanics than as clerks by default. To these you can add the reluctant collegians who always wanted to run a filling station or a bulldozer.

Perhaps the best way to stop the segregation between book-schools and machine-schools might be to set up compulsory courses in the mechanics of modern living. A would-be chemist might find some personal practice with machines a handy knowledge later. And a future second-rate hardware salesman might dare to try for first-class toolmaker.

Perry Githens

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"My car was driven 80,000 miles before engine overhaul," says California motorist. "It was equipped with a Fram Oil & Motor Cleaner. When I tore motor down, only sludge was below oil pump about 5" in diameter and ¼" thick. Greatest wear on crankshaft was .0005". Reassembled motor using new rings, valves, guides, standard bearings. Later, on 3000 mile trip, added only one quart of oil. Now have 115,000 miles. Consider Fram Oil & Motor Cleaner best investment I ever made."

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Now in use on over 12,000,000 cars, the famous Fram Oil & Motor Cleaner "cleans the oil that cleans the engine." Reduces engine wear and extends engine life by removing harmful dirt, soot, grit, sludge and abrasives from your oil. Outside-in flow assures greatest filtering area. Large sump area increases cartridge life . . . allows heavy dirt, carbon and metal particles to settle to bottom of filter where they can be easily removed.

Famous Fram Filcron Cartridges are the working part of the filter. Remove harmful particles down to one micron (.000039") in size. Offer highest clean oil flow rate, maximum dirt capacity, longer cartridge life, lowest clean oil cost per mile. Exclusive non-abrasive filtering media . . . positively will not remove additives from compounded oils. Can be changed easily . . . quickly . . . economically when effective life is spent.

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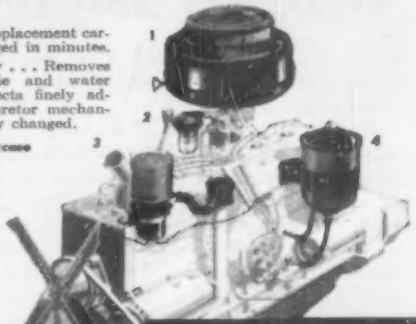

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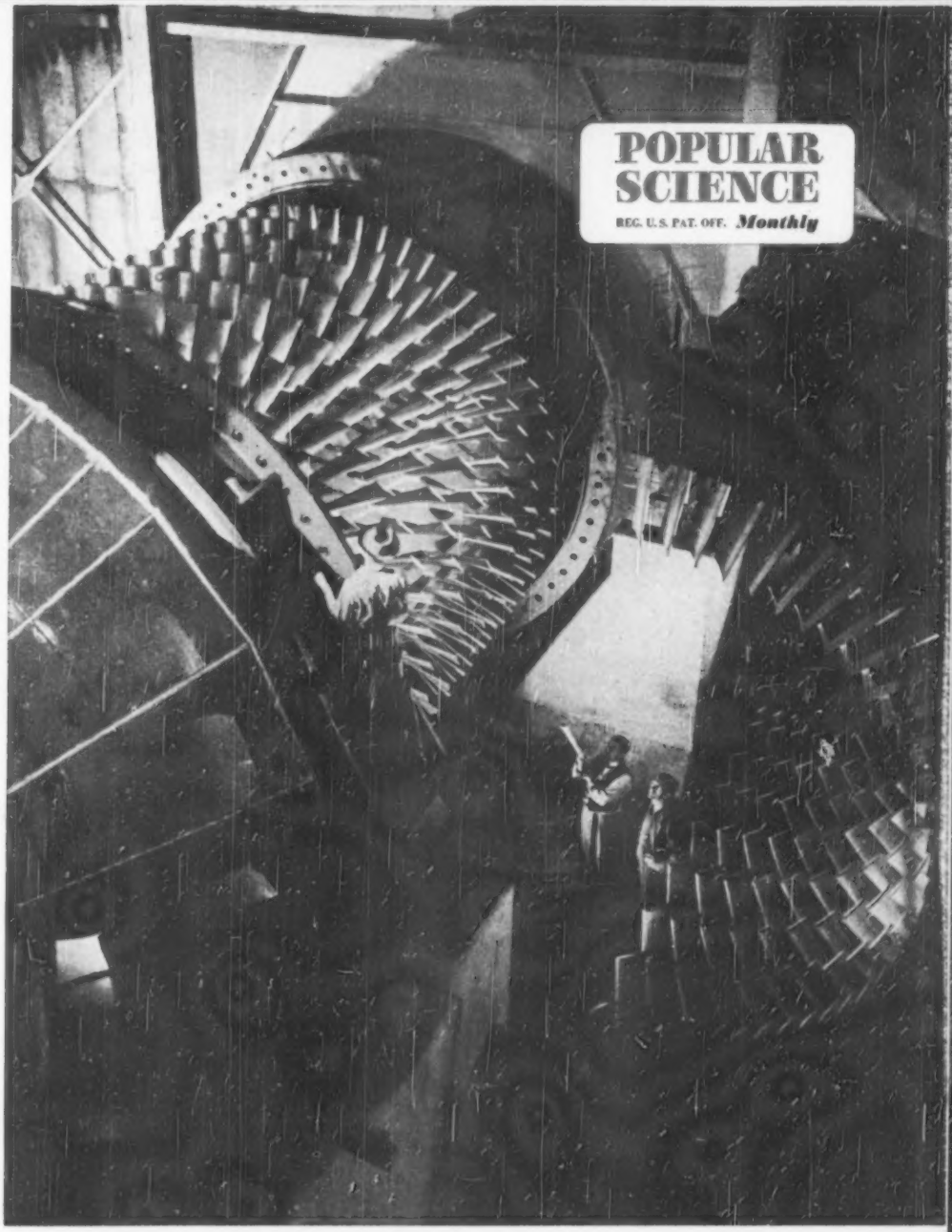


Open Wide, Please... At right above is one half of the giant "jaws," opened for inspection, that house the air compressor for the world's largest faster-than-sound wind tunnel at Cleveland's Lewis Flight Propulsion Laboratory. "Teeth" of the jaws are the stator blades; those on the massive shaft at left are the rotor blades. Driven by three electric motors developing 87,000 hp., the compressor draws 2,000,000 cubic feet—75 tons—of air a minute through the tunnel to give it speeds up to twice that of sound.

Luxury Sports Car Rides the Range

Cover drawing by Reynold Brown

This superduper dream job is built to go where the deer and the antelope play—and to carry the ranch boss there in style.

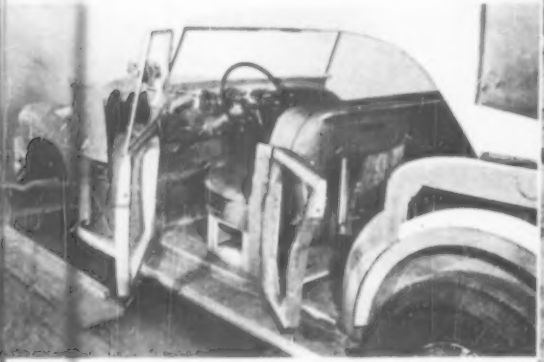
By Devon Francis

Photos by Ken Adderley

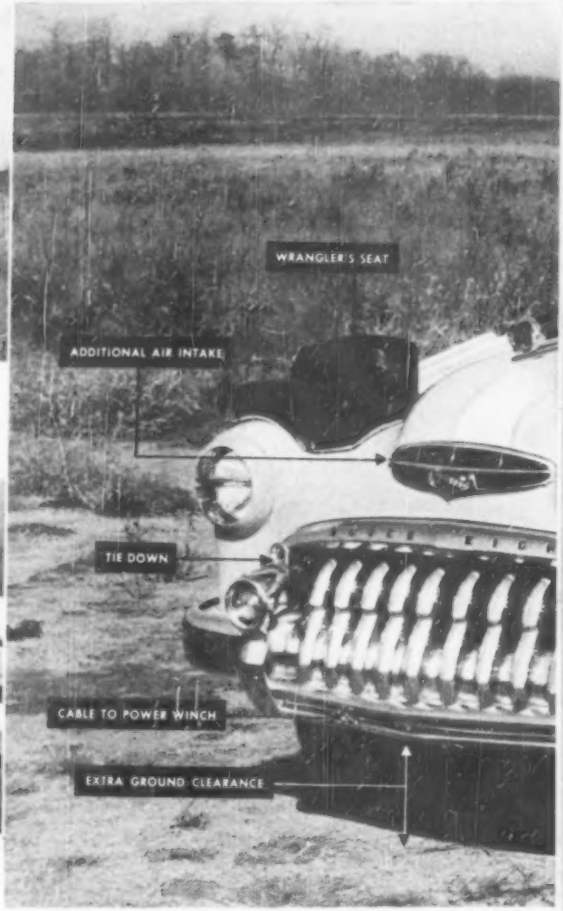
THE kind of an automobile that most everybody dreams about—a luxury job built to one's personal specifications—was delivered the other day to Richard Mifflin Kleberg, boss of the almost legendary King Ranch on the Texas Gulf Coast. It may be the fanciest car in the U. S. Certainly it is one of the fanciest in the world.

It was built to roam the mesquite-studded expanses of America's greatest private land empire, covering nearly 1,000,000 acres. A ranch car de luxe, it was engineered to order by the Buick Motor Division of

Old ranch car that new Kleberg luxury car replaces shows earlier versions of same basic ideas. Game forks, gun wells, winch, method of carrying spare wheels, are recognizable.



Before construction of new car was started, full-scale drawings were made and this wood "trim buck" was built to test seating and equipment like fender and seat-back compartments.



Special Buick Dynaflow built for King Ranch only superficially resembles company's familiar Roadmaster model. A 1949 frame was reworked to cut wheelbase 5¼ in. to 121. Large rear overhang boosts bumper-to-bumper length to 213 in., compared with standard 209, while height is 6 in. greater. Chassis and body members are extra-braced throughout to accommodate empty weight of 5,464 lb., 900 lb. greater than frame was built to carry. Axle shafts and steering

General Motors, and designed jointly by Buick and the GM Styling Section. It was made for hard usage. Even the engraved silver handrails bolted securely to the dash and to the back of the front seat are there for a purpose. For this car will be driven cross-country, without benefit of roads, more than it ever will be driven on a highway.

The concept of the car began late last winter when a representative of the Styling Section visited Kleberg on his ranch. The tough, weather-creased boss man already had a ranch car. It had been made right there, using a standard car as a foundation. It had served its day. Kleberg figured as how he was in line for a new one.

He and the GM man took off across the mesquite, hog wallows, and dry washes at 60 m.p.h. The visitor got his teeth jolted.

"See what I mean about those handrails?" asked Kleberg.

Pretty soon they flushed some sand dunes.

"You're not going to drive over those!" exclaimed Kleberg's guest.

"Sure am," said the rancher.

He valved some air out of his tires to give the wheels more surface area, pressed the starter, and away they went. Once through the sand, Kleberg calmly fished a carbon dioxide fire extinguisher out of the luggage compartment and pumped up his tires again to normal pressure.

"So I need a good ranch car," concluded Kleberg. "See what I mean?"

GM started from taw. It took six months

components are made of nickel-chrome-moly steel and shot-peened for extra strength. Heavy-duty radiator core was provided. A 1½-gal. storage tank mounted over engine stores additional cooling water. Cooling system capacity is 32 qts., compared with usual 18. Extra hood opening above grille provides 35 sq. in. additional aperture for air entry. Hood, doors, and deck lid are of aluminum alloy .064 in. thick. Rear quarter panels are 20-gauge steel. The 15 by 8.90 six-ply tires are size of light-truck tires. Collapsible top is manually operated to save weight. Curtain frames snap into door sockets and are secured by screw locks. Spring-loaded, chrome-plated plaques close sockets when curtains are removed. Each compartment in car lights up automatically when it is opened. Tie downs on parking lamps and running boards are for lashing on game. Car's predominant color is beige. Top is suntan fabric.

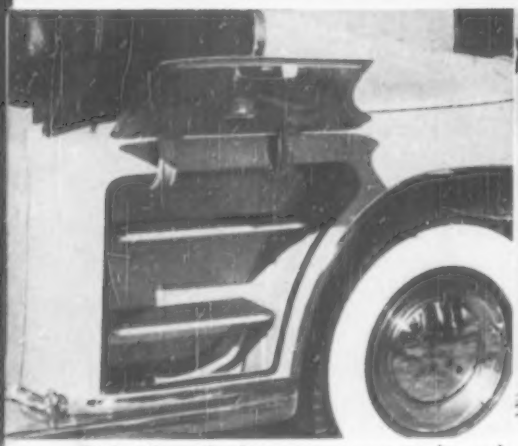
to design and produce exactly the automobile that Kleberg wanted.

It's strictly functional. On the front right fender, which is beefed up to take the load, there's a demountable wrangler's seat complete with an airplane-type safety belt. On the left front fender is a rustproof-steel fork, also demountable, to hold any big game the rancher happens to shoot. Fenders hold six guns, with leather cases, within easy reach of the driver and his front-seat passenger.

The car has a two-way radiotelephone; a power winch to drag it out of holes, sand, or mud; a first-aid compartment; a refreshment bar; ammunition-storage space; cast-aluminum running boards impregnated with Carborundum® for sure footing; an extra-large radiator and an emergency water supply for Texas heat; a tachometer, compass, and sensitive altimeter; an outsize gas tank; and hydraulic-assisted power steering.

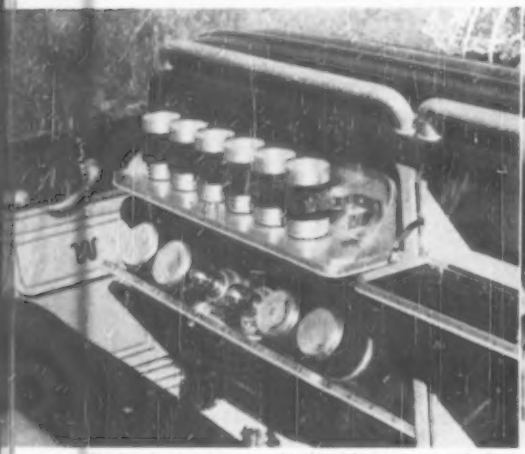
That's only a peek. Here's more:

The biggest passenger-car tires available; special wrap-around bumpers to protect the body and fenders from dents; extra-heavy-gauge body and fender steel; three extra inches of ground clearance; modified wheel-base and over-all length; a collap-



Either front fender compartment can be used for ammunition storage. Shelves are hinged, and fold back flat. Compartment in right fender can be reached from inside car through flap door.

Or either can be used to carry 5-gal. can of emergency water. Can is secured by strap. Fenders are formed of 18-gauge steel, heavier than usual, to discourage denting in rough terrain.



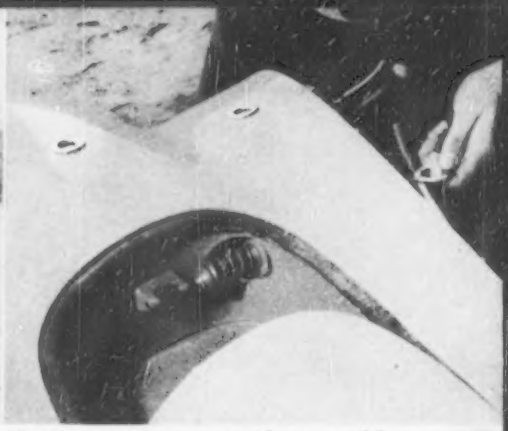
Refreshment bar on back of front seat includes aluminum tumblers banded in suede and crested with Running W, King Ranch brand. The fixings below them include an adequate ice supply.

For special guests car sports pony-skin rug. Leather seat trim is dark brown cowhide. Compartments to right of bar are for general storage. Cigarette lighters, ash trays adjoin seat.

Car's design takes advantage of every inch of space. Here curtains are stored behind rear seat in special fabric containers. Hinged seat pulls forward to give access to compartment.

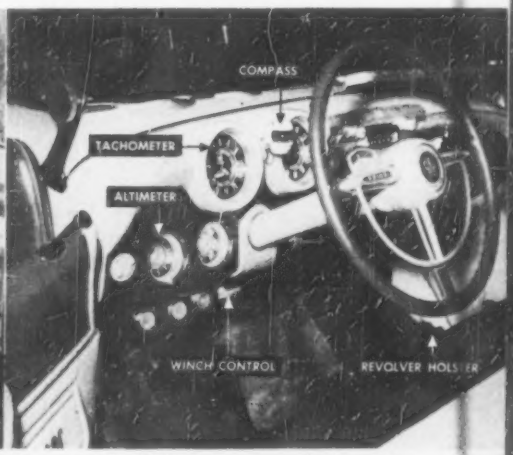
Under front seat is first-aid kit containing bandages, hypodermic syringe, splints, tourniquet. Compartment posed problem because Kleberg wanted seat adjustable 2½ in. fore and aft.

Heavy leather gun cases in metal fender inserts carry three weapons on each side of car. Slanting windshield can be flattened to hood level by loosening knobs on sides of its frame.



Metal inserts for guns can be removed by releasing spring catch from under hood. Back end of insert has a slip-under anchor. A cover plate contoured to a normal fender line replaces it.

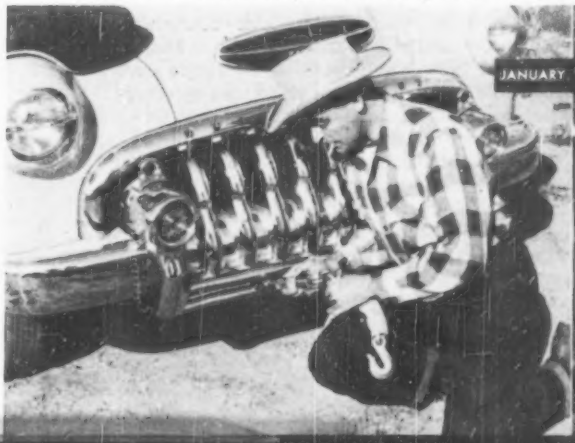
Radiotelephone is tucked into right end of engraved silver instrument panel, which is styled like 1950 Buick's. Long-range regular radio receiver will pick up most U. S. stations.

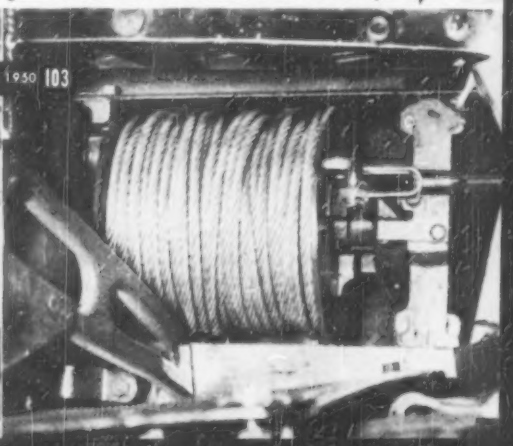


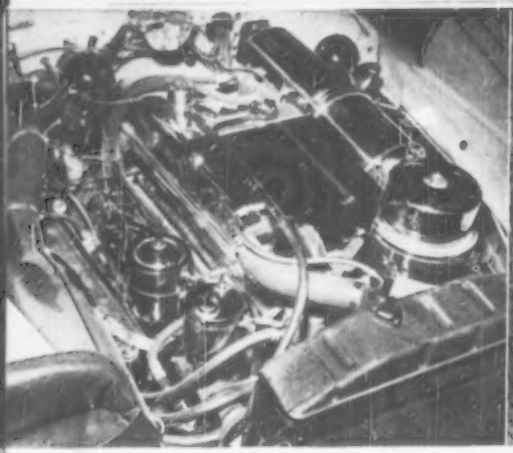
Steering wheel also has engraved silver mountings. Running W motif starts with radiator ornament and is applied liberally in car's interior. Kleberg's ignition keys are gold-plated.

Leather-wrapped chain with hook is attached to end of winch cable with a quick disconnect. Grille opening through which cable is payed out is lined horizontally and vertically with rollers.

Winch, behind grille, is driven off front of engine through special clutch and worm gear. It contains 150 feet of cable rated for 6-ton pull. It can be hand-cranked if necessary.

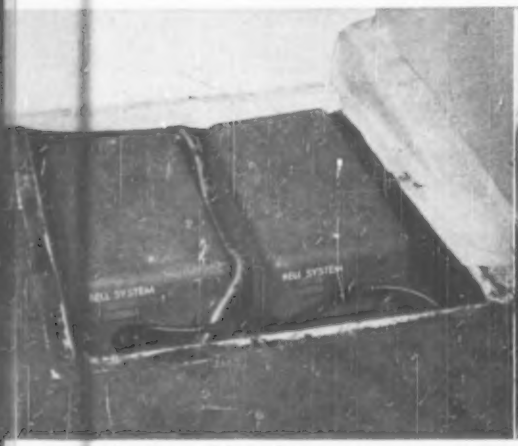




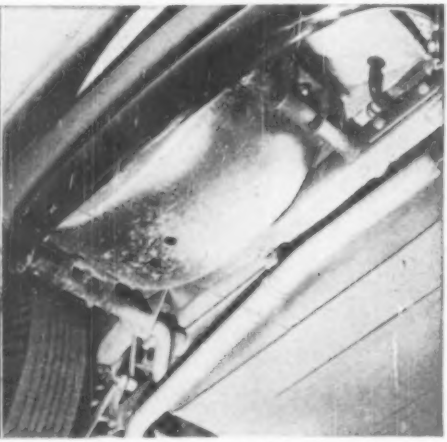


Engine is basically standard Roadmaster straight 8, developing 152 hp. at 3,600 r.p.m. Extras include chromium plating, coolant tank, oil-bath filter on engine-ventilation system.

Brakes have oversize linings and dust seal (arrow) cemented to backing plate. Power-steering system has mechanical linkage to back-stop failure of hydraulic-assist mechanism.



Under floor of huge luggage compartment are the radiotelephone units. Floor is skid-stripped, covered with tough plastic. Axe, fire extinguisher, other emergency items are carried here.



Steel guards, skids, and plates have been attached at all critical points on underside of car to prevent damage to engine or drive mechanism if stumps or holes are encountered.

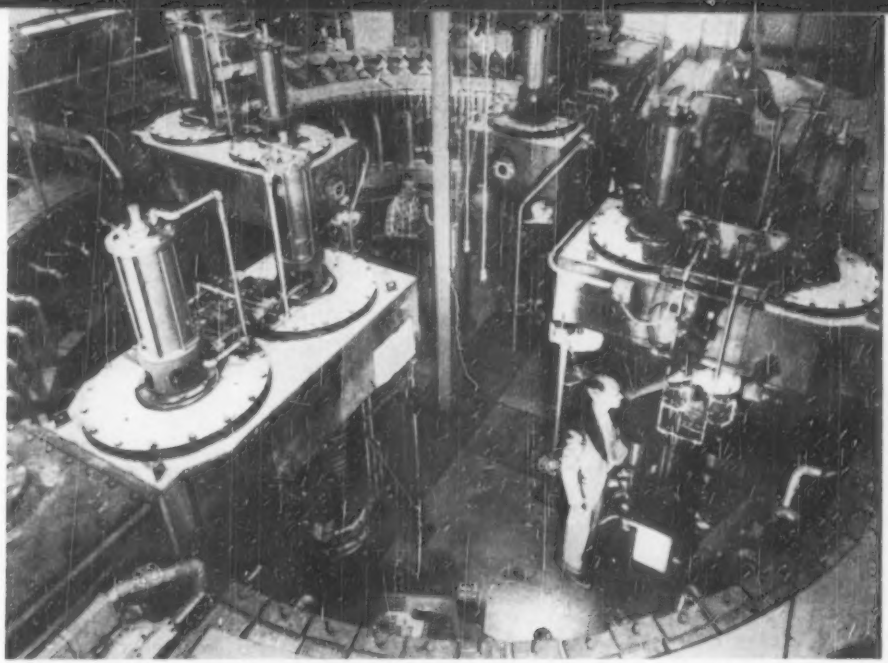
sible top with Plexiglas® side curtains; a *spare* spare wheel; a tinted windshield to filter the sun's rays; a luggage compartment twice as big as usual; adjustable-pressure air cushions for custom seats; aluminum doors, deck lid, and hood to save weight; and 19 compartment and "courtesy" lights.

Still more: a reworked bumper grille to accommodate the winch cable; foam-rubber linings for all compartments and as a base for the leather-covered car "belt"; chromed exhaust pipe; an extra-width fan blade for additional engine cooling; removable deck lid; chrome kick pads on doors; snap-lock shelves in both front fender compartments; barred headlights to protect the lenses; and a special leather-wrapped steering wheel.

And there's still more, but a man has to stop and catch his breath somewhere.

Practically everything about Kleberg's ranch car, called El Kineño (regional Mexican for "The King Ranch"), is special except the standard Roadmaster® engine, Dynaflow® transmission, and wheels.

The cost? Well, nobody around the big Buick plant at Flint, Mich., or at the GM general offices in Detroit seems inclined to talk about it. But you get the impression that if you would like to have a dream car built to your specifications, it would help if you started off by owning a million-acre ranch or a share in the U. S. Mint. END

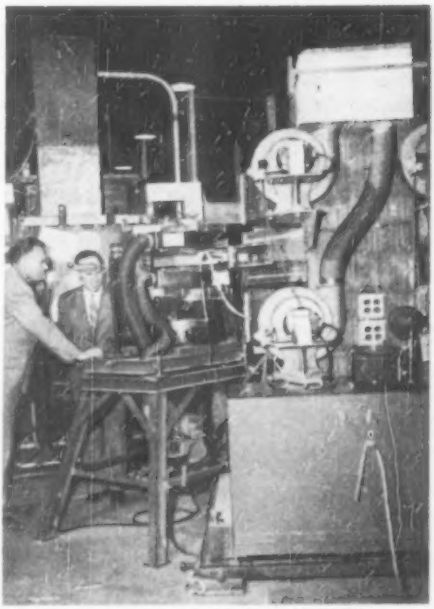


Working model of giant Bevatron atom smasher has ring-shaped magnet of 25-foot diameter.

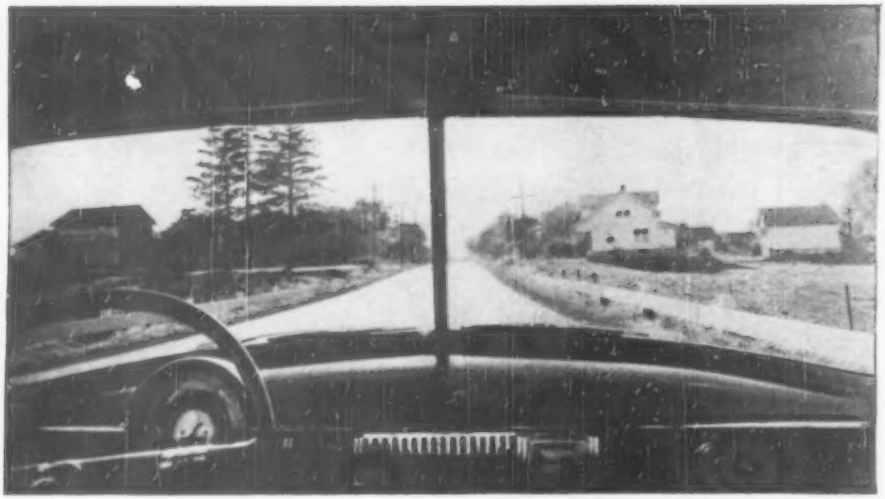
"Baby" OKs Biggest Atom Gun

TESTS of a quarter-scale model have just given the green light to plans for the world's mightiest atom smasher, the University of California's projected $9,000,000 "Bevatron." Expected to be ready for first tests by midyear, the full-scale atom gun will hurl protons at a target with the colossal energy of six billion electron volts, placing controllable beams with the power of cosmic rays at the disposal of physicists (PS, July '48, p. 270). Delivering one-tenth of this power, as planned, the pilot model shown here operates with an efficiency that fulfills its builders' fondest hopes, declares Prof. Ernest O. Lawrence, director of the University's Radiation Laboratory.

Most prominent part of the model is an electromagnet of "racetrack" shape, a ring 25 feet in diameter with a short straightaway section at each quarter of its circumference. The magnet's hollow interior contains a doughnut-shaped vacuum tube of 100-foot perimeter. Speeding protons are fed into this tube by a 10-ton cyclotron. After this, the charged particles are further accelerated in making 150,000 complete laps around the magnetic racecourse. Successful trials of the Bevatron model have vindicated its revolutionary design.



Ten-ton cyclotron, above, injects speeding protons into 100-foot accelerating tube of model. In the full-size machine, either a larger cyclotron or an electrostatic generator may be used.



New Safety Glass Cuts Glare

BRIGHT sunshine won't bother your eyes as much when you are out riding if the auto's windshield and windows are equipped with a new glare-reducing safety glass. Tinted a bluish-green, the glass shuts out more than 15 percent of heat-giving infrared rays and a large amount of the ultraviolet rays that fade upholstery. In photo above soft light comes through E-Z Eye® glass in left half of windshield while glare shows through ordinary glass in right half. Libbey-Owens-Ford makes the new glass.

Harvesters Help Peter Piper Pick More Pecks

WORKERS in two parts of the country have discarded the old stoop-and-squat technique of harvesting cucumbers. Now they sit or lie in vehicles that carry them close to the ground—and the cukes.

At left below workers sit on a machine self-propelled by a 1½-horse engine. It is steered automatically by a trailing guide arm that follows a furrow, dug beside every third row. Covering three rows, it's used by Prayrie Orchards Farm, White Pigeon, Mich.

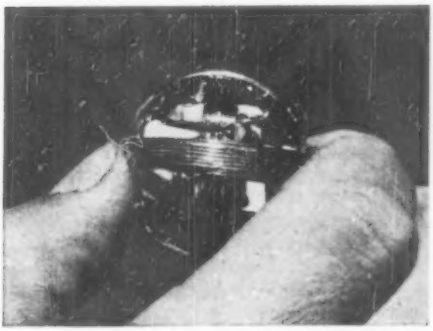
In the photo at right, a tractor-pulled platform is shown in operation near Oregon City, Ore. Four workers, one to a row, lie face down on the platform as they pick and feed cukes into a conveyer belt that dumps them into sacks at one end of the vehicle. Developed by C. P. Sivertson, of the U. S. Department of Agriculture, the harvester is also usable on other row crops.

Litter Picker Cleans Itself

PICKING up trash from lawns and beaches is easy with this mechanical picker. Made of aluminum with plastic hand grips, it stabs assorted debris with twelve sharp prongs as shown at top. When the prongs are full, a downward thrust on the center grip pushes in a plunger that forces a spring-held stripper down along the prongs, ejecting the load. The lower photo at left above shows how the gadget can pick up and eject a single cigarette. A twist of the grip locks the stripper at the end of the spikes for safety (right). The device is made by the Belmar Wheel and Machine Co., of Belmar, N. J.

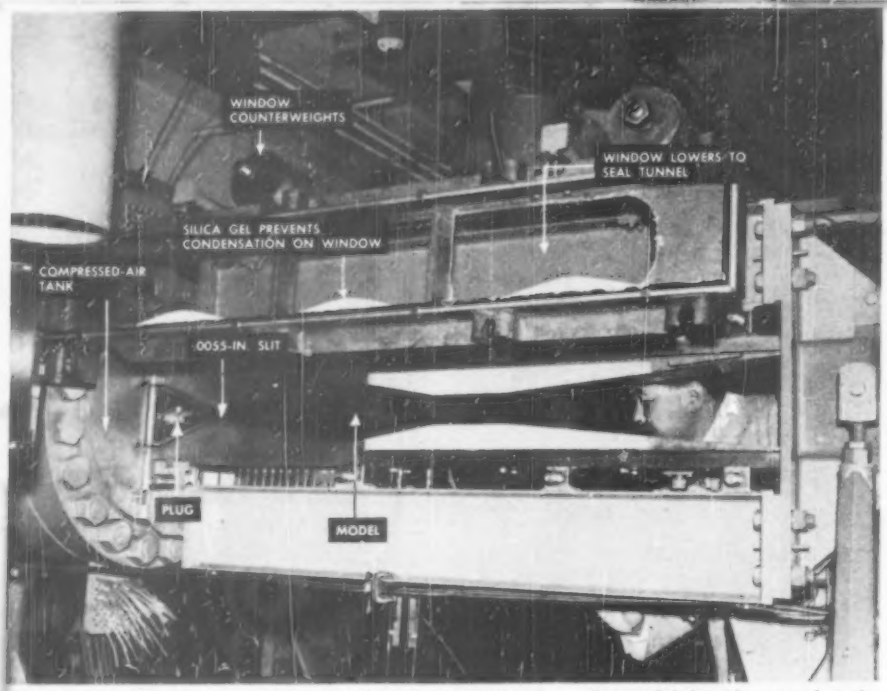
Small Scooter Packs Power

THIS lightweight baby carries a man-size load in scooting around large industrial plants, parking lots, or airfields. It is powered by a one-cylinder, two-cycle engine through a chain drive to the rear wheel. Top speed is 25 m.p.h. The frame is made of one-inch, gas-welded steel tubing, and the steering post is jointed so that the cycle can be stored in small spaces. The two-wheeled midget scooter was developed by the Randolph Sales and Engineering Co., of Cuyahoga Falls, Ohio, which believes that it is the smallest powered scooter on the market. The one-man vehicle sells for around $150.



Tiny Radio Tests Dogs' Nerves

PLACED under a dog's skin, this tiny GE radio receiver, the size of a golf ball, now lets scientists study the animal's nerve reactions under normal conditions. Previously, experiments involving electrical stimulation of a nerve had to be done with the dog anesthetized or with wires leading through its skin. Now the skin-buried receiver picks up a radio signal and stimulates a nerve, while the dog can move normally. The insertion, during anesthesia, is painless and the wound quickly closes over the receiver.



This, the world's fastest wind tunnel, lets engineers see what would happen if that tiny model were flying at Mach 10 at an altitude of 163,000 feet. The model doesn't move, but the air does—at 1,790 m.p.h. Caltech developed the tunnel to test rockets for Army Ordnance.

Supersonic Too Slow— Now It's Hypersonic

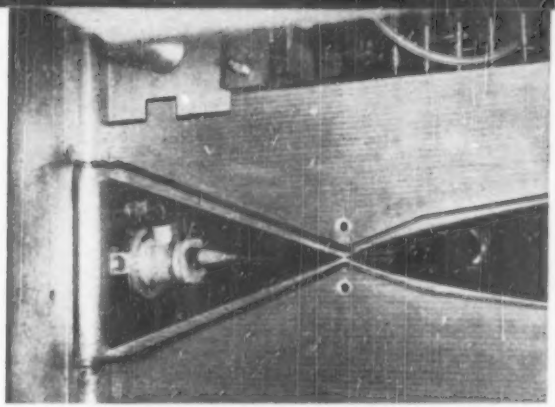
THE latest U. S. wind tunnel uses such high speeds that they had to think up a new name for it: hypersonic. That means quite a bit faster than supersonic. The new tunnel can test models at 10 times the speed of sound—Mach 10, as engineers say.

Already, full-size missiles have reached Mach 7 (the Wac Corporal-V-2 combination did slightly better than that last year). So California Institute of Technology built for Army Ordnance the new tunnel that operates at the still higher speeds of tomorrow's rockets.

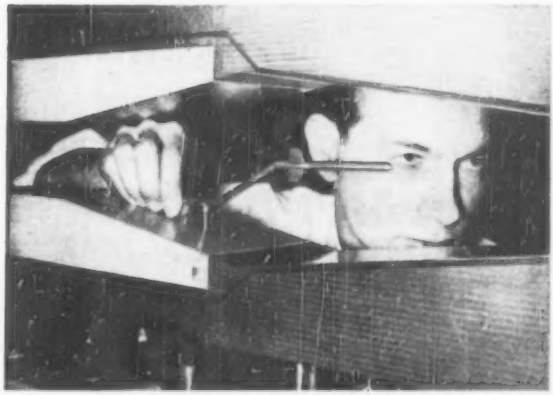
Caltech gets its hypersonic wind by compressing air in a tank. A battery of 15 compressors raises the pressure to 290 pounds per square inch. Then a hydraulic control pulls out the plug—a rubber-tipped steel wedge closing a slit only .0055 in. wide. The air rushes through this slit at the speed of sound. It expands into the "working section" of the tunnel until it is very cold, as thin as the air at an altitude of 163,000 feet, and moving 1,790 m.p.h. This speed is 10 times sound speed under those conditions of temperature and pressure (it's the relation of speed to sound speed—Mach number—that interests engineers, not m.p.h.)

The model itself is about as big as a pencil. It is mounted in a working section only five in. long. A special camera makes Schlieren pictures of the shock waves in the air as it flows past the model (see photo at bottom of facing page). It uses mirrors to reflect parallel rays of light through the tunnel's glass windows. The beams of light are disturbed by the shock waves, which act as tiny lenses, so that the waves show up as lines in the photograph. The whole camera system can be moved along the tunnel on an overhead track to photograph what happens ahead of the model and behind it.

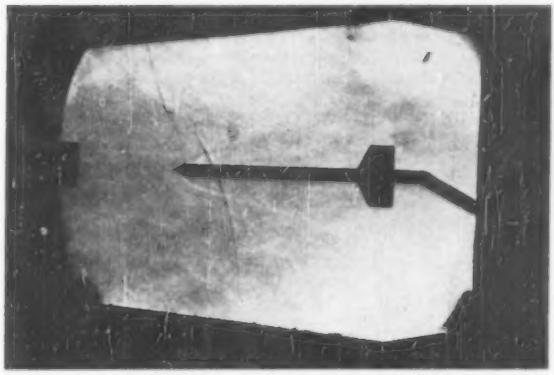
By studying these photographs, the engineers learn much about shock waves and air flow—information that will help them design rockets to fly ever higher and faster.



Tunnel is turned on and off by fast-acting steel wedge at left, which plugs .0055-in. slit admitting air to test section. Hydraulically operated, it moves in and out four inches.



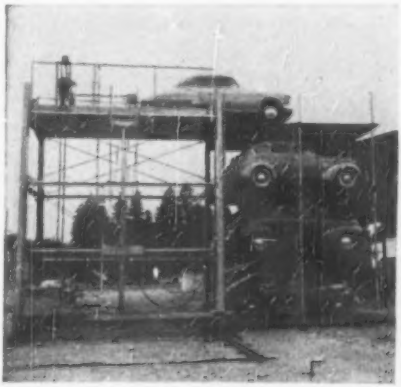
Engineer adjusts pencil-size model for a ride in the hypersonic breeze. Temperature inside test chamber drops sharply as high-pressure air expands after passing through the slot.



Pressure pattern around model "flying" at Mach 10 is shown above. Note shock wave trailing back from nose. Pictures tell engineers much about rocket performance at high speeds.

Radar Plane Joins Navy

KEEPING a watchful eye over the fleet is the latest job taken on by the Douglas AD-3W Skyraider. This version carries radar equipment that can detect an approaching enemy hundreds of miles away. The radar antenna is covered by a plastic radome bulging under the forward part of the fuselage. More than 500 Skyraiders, useful for many reconnaissance and combat duties, have joined the Navy's air arm in the past three years.



Pigeonholes Store Cars

THIS parking system would "file" your car in a pigeonhole. A small lift takes the car into the main elevator, which moves sideways on tracks and raises the car to any of four levels. The lift then puts the car into an empty stall in the steel storage racks lining both sides of the track. The system, called Pigeon Hole Parking, was invented by Leo and V. A. Sanders. The Peters Company, Portland, Ore., makes it.

Imitating the movements of a man's arm, three booms on machine lift workers up into the branches of a tree. This method of harvesting is said to enable three men to do work of eight.

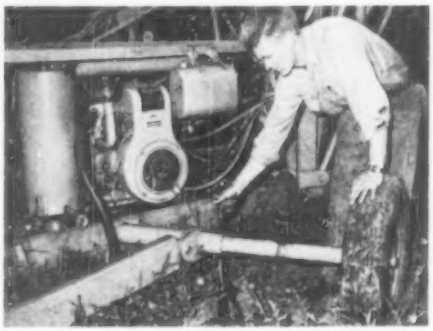
Operating four levers that control the hydraulic cylinders and move the boom, the worker above easily maneuvers his platform to the proper position for plucking fruit off the tree.

Elevators Lift Fruit Pickers

THIS machine takes the ladder-climbing out of fruit harvesting and tree pruning. Mechanized booms, jointed like a man's arm, lift workers on platforms up into the branches of a tree.

Hydraulically operated by a 7½-hp. gasoline engine, the trailer-mounted booms can be moved up and down in a 180-degree arc and from side to side in a 330-degree arc. Four levers on each boom control its action.

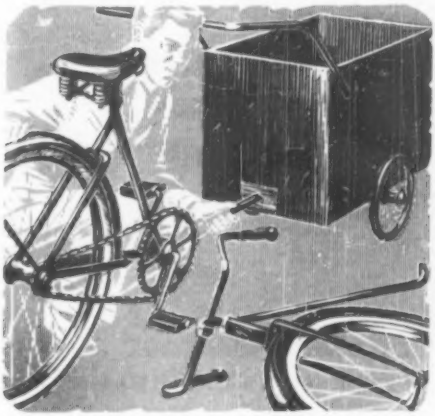
For working on a hillside, the trailer has a telescoping front-wheel axle that can be extended to 12 feet to give a firm footing. Ormand Hukari, of Hood River, Ore., inventor of the machine, says it enables three men to do the work of eight.



To give the machine a firm grip on a hillside, the trailer is jacked up and its telescoping front axle extended. Operator at right locks the axle in place by inserting a single pin.

New Ideas from the Inventors

1 Bath to Simplify Plumbing. With this combination bathroom unit, only one drain line and one hot- and one cold-water pipe would be needed. Toilet, bath, and basin drain into a single pipe, while one hot-and-cold-water faucet, arranged to swivel, serves both the basin and the tub. Easily installed, it is designed to reduce plumbing costs and installation problems in small homes and apartments.



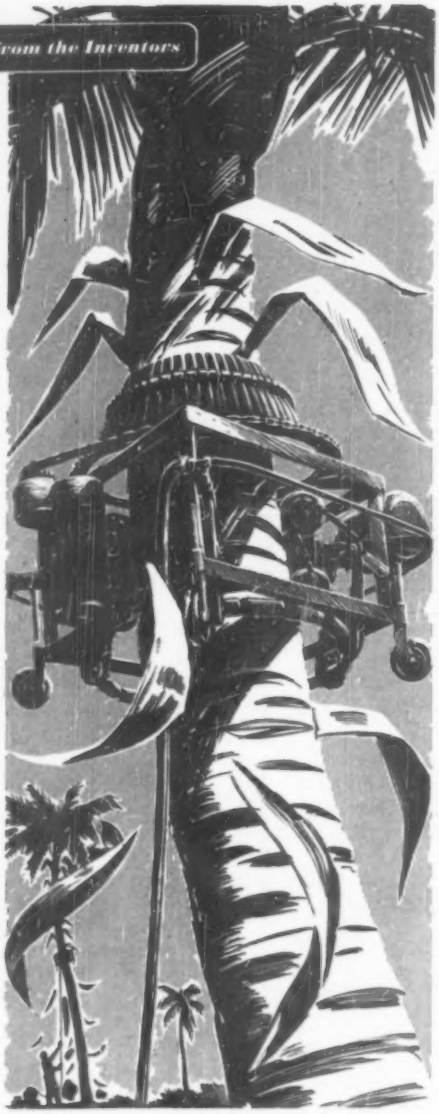
2 Bike to Serve Double Duty. This bike, with its come-apart frame, could not only be used as a conventional bicycle, but as a driving unit for a delivery cart or baby carriage. The front wheel is simply detached from the bike, and the rear-wheel assembly is attached to the cart. A swivel coupling permits steering the cart.

3 Rail Car to Aid Track Workers. Setting railroad-track spikes so they can later be driven by mechanical or other means has always been a back-breaking job. A spike setter, riding this rail car, would need only push himself along the track as he works. He sits on a comfortable seat; spikes are fed to him from a bin.

Turn the page, please, for three more new ideas

4 Tool to Make Wiring Easier. For hard-to-get-at wiring jobs, this pencil-like tool feeds the wire as needed. A spool holds the wire, while a restricting nipple at the tool's tip insures just the right tension as the wire is wound around the terminals. A finger-operated cutter snips the wire when connection is complete.

5 Rotary Tool to Mount Tire. With this rig, one man could squeeze a heavy tire onto a wheel with little effort. He simply rotates the arm clockwise around a center post imbedded in the base. This causes the horizontal roller to force the bead outward. The vertical follow-up roller then presses it downward past the flange.



6 Trimmer to Climb Trees. Particularly suited to palm trees, this automatic trimmer would climb a tree under its own power to cut off dead fronds or branches. Powered by electricity, hydraulically adjusted motor-driven rollers move the trimmer up the trunk, while a circle of rotating nippers shears off the dead leaves.

Patents on these inventions have been granted to: 1. T. H. Sarchet, Spokane, Wash.; 2. G. G. Hauptman, New York, N. Y.; 3. K. and R. Kershaw, Montgomery, Ala.; 4. E. Burrell, Cook County, Ill.; 5. R. Moore, Orange, N. J.; 6. R. E. Whitaker, Los Angeles, Calif.

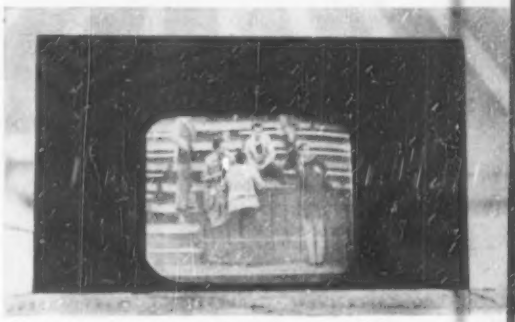
TV camera fitted with new "lens" is trained on people at opposite side of football field, 400 feet away, for test. What you would see on screen of home receiver is shown in picture below.

"Lensless Lens" Gives TV Long Eye

YOU can see whether a man more than a city block away is smiling or frowning when a TV camera uses a new long-range "eye." Employing a concave mirror instead of a lens as its principal optical element, this telephoto objective resembles a reflecting telescope in principle.

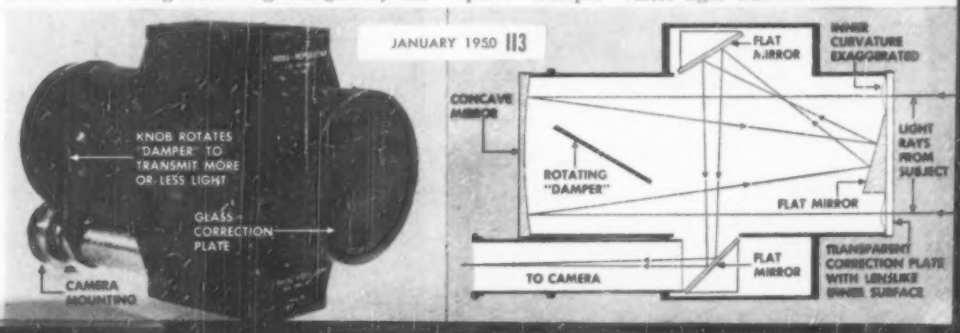
Conventional long-range lenses of equal power have many lens elements, making them too long and heavy to be used on lens turrets of TV cameras. These handicaps are eliminated by the new "lensless lens," the Video-Reflectar®, designed by Dr. Frank G. Back, who invented the now-famous Zoomar® vari-focal lens for movies and television (PS, Aug. '47, p. 126).

Lightweight mirrors replacing heavy lens elements provide 40 inches of focal length in an objective only 16 inches long and weighing less than six pounds. Light rays from the subject enter the camera through a lenslike correction plate with a slight inner curvature, precisely calculated to correct spherical and other aberrations of the rest of the optical system. The rays are then formed into an image by a concave mirror and transmitted to the TV camera by three flat mirrors. To regulate light transmitted, a knob turns a "damper," resembling a furnace damper, that replaces the conventional iris diaphragm and gives equivalent light-transmission values from f/8 to f/22. END



People in distant grandstand nearly fill frame of image produced by new "lens," as seen on monitor screen that duplicates home receiver's.

Close-up and diagram of new "lens" show how it works. Image formed by concave mirror is reflected through three right angles by flat mirrors. This gives image long light path, required by mirror's 40-in. focal length, in small space. "Damper" varies light transmitted.



Britain's portable atomic furnace fits inside a small copper-can shield. When operating, it is kept in the "grave"—a brick-lined hole in a cellar floor—for added protection against rays.

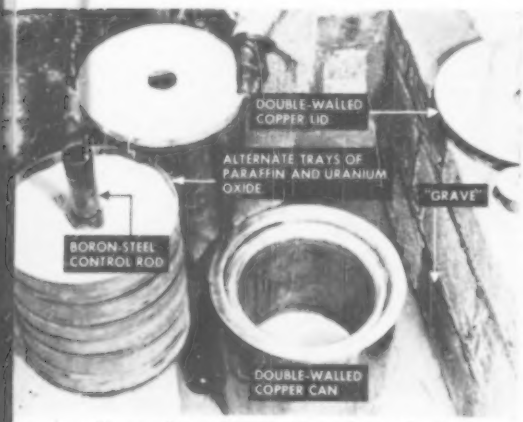
Atomic Furnace, Ash-Can Size, Makes Isotopes

AN ATOMIC furnace small enough to fit inside an ash can may soon be producing radioactive materials for research. Developed in England, the whole thing weighs 200 pounds, costs $4,200.

The "Aspatron" has nine shallow copper trays: five containing paraffin; and four, uranium oxide. The trays are stacked alternately inside a double-walled copper can. Any uranium compound gives off some rays naturally. The effect of the paraffin and copper is to multiply this radiation. Water between the can walls keeps deadly rays from getting out, and a boron-steel rod can be inserted down the center to stop the reaction.

The Aspatron is not a true "reactor." It generates far less energy than a giant pile like Brookhaven's (PS, April '49, p. 121), which is bigger than a house and cost millions. But it is reported to make ordinary things radioactive. And these radioisotopes, claims the inventor, can serve as the "tracers" now widely used.

Most atomic scientists are skeptical. They say the unit will make isotopes, all right, but—as so few neutrons are generated—the isotopes would be too weak to be useful.



Trays of uranium oxide and paraffin that form active part of pile are stacked together. Material to be made radioactive would be put in center pipe, and control rod pulled out.

Aspatron's inventor, 25-year-old Robert Barker (left), and Major Conrad Walsh, head of ASP Chemical Co., claim unit may be used in hospitals to make valuable, short-lived isotopes.

Jato Boosts Light Plane

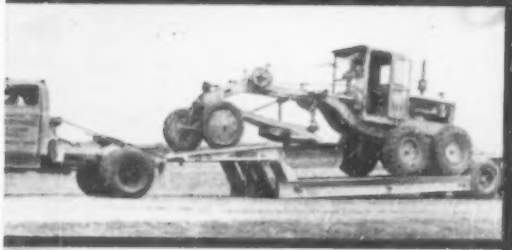
THE 50-lb. steel bottle being attached to the belly of the Ryan Navion plane above is a new Junior Jato rocket engine. It enables the fully loaded plane to make a 300-foot take-off over a 50-foot obstacle. Without Junior, it would take about 800 feet. Adding extra punch to the plane's 205-hp. engine, the rocket's 250-lb. thrust results from the rapid burning of a solid-fuel propellant. Developed by Aerojet Engineering Corp., the 6- by 18-inch, self-contained unit is not yet available commercially.

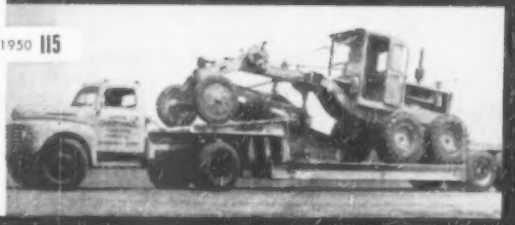
"Raindrop" Reflects Radar

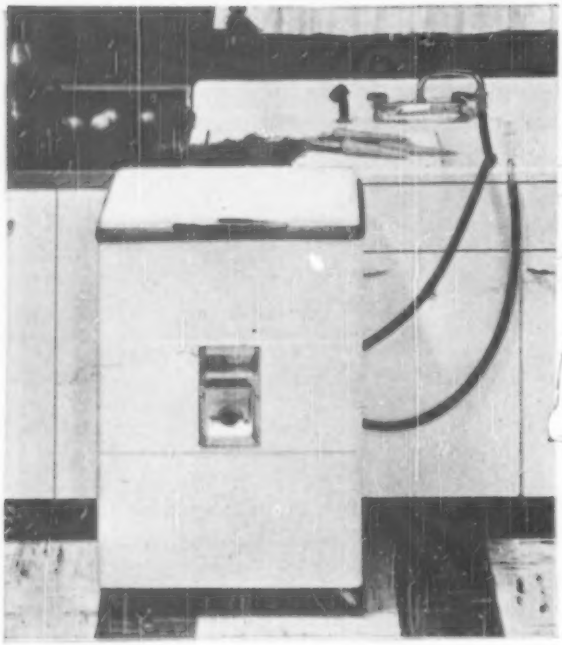
THE little black object the man at left below is holding is a plastic "raindrop." He's holding it in radar waves, beamed by the antenna at top rear, to study the scattering effect of rain, sleet, and snow on ultra-short-wave military radar. The make-believe drops were developed by Westinghouse engineers because facilities weren't available to generate extremely small microwaves; instead of scaling down the waves, they scaled up the raindrops. Oversize drops, up to an inch and a half in diameter, were made of plastic to have the same electrical characteristics as regular rain. The "echo" picked up by the horn-shaped receiver at right is fed to sensitive measuring instruments on the table.

Trailer Has Loading Ramp

THE odd-looking platform below, for hauling equipment to a construction site, is both trailer and loading ramp. The front end of the trailer lies flat against the ground (top photo) to receive a road grader. When the load is in place on the platform (center), a power-operated winch on the back of a truck hoists the trailer, which "goosenecks" upward and backward for hitching to the truck. The low-slung trailer (ready to roll, in bottom photo) is made up to 100-ton capacity by Martin Machine Co., Kewanee, Ill.







Simplified Dishwasher Solves Husbands' Problem

Fed-up kitchen conscript designs low-priced, portable machine to de-scale tableware with hydraulic jets.

By Devon Francis

PS photos by Hubert Luckett

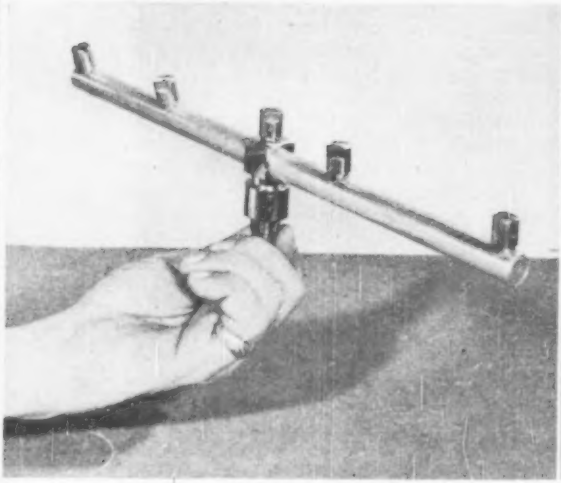
LET this be the story of the husband who got fed up with helping the wife do the dishes—or listening to her talk about the husbands who helped.

It begins four years ago. Here he was, a consulting engineer, washing or wiping dishes for a family of six by hand, the way millions of kitchen conscripts have done it for centuries. He decided to do something about it—if he had to invent it himself.

He did. Jerry La Raus—for that's his name—of Westport, Conn., has put a dishwasher on the market that will wash off dried egg, dried breakfast cereal, dried jam, and cigarette butts immersed in cold bacon grease. Turn it on and forget it. It sells for $169.50, and there is no installation charge because there is no installation.

La Raus made his own dishwasher because he wasn't satisfied with what he found on the market. He wanted a dishwasher that 1) was fully automatic, 2) required no plumbing installation, 3) was portable, 4) was big enough to take care of a good-sized family, 5) would wash the dirtiest dishes clean, 6) operate on ordinary household heating-tank temperatures, and 7) not be dependent on faucet pressure.

He had problems. Most mechanical dishwashers on the market shot water up from



Heart of new dishwasher is revolving twin-armed jet unit. Reaction forces are nearly balanced, so arms turn slowly. High-velocity, chisel-like jets from nozzles "scale" dishes. Center jet washes silverware. Jets clean pans, too, but cooked-on food should be loosened first.

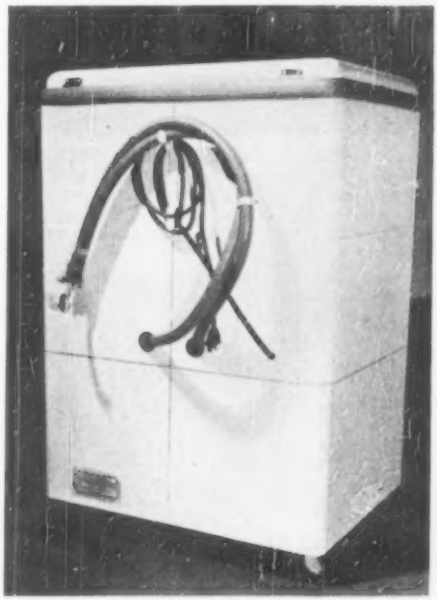
Rotary pump, here shown disassembled, is positive-displacement type. It has a stainless-steel shaft, neoprene impellers, and graphite bearings. Pump makes jets independent of faucet pressure and also discharges dirty water back to sink. It is designed to be nonclogging.

the bottom of the tub by a fan. The water was *sprayed* on the dirty dishes. Some dishes didn't come clean. La Raus bethought himself of the hydraulic jets used to take the scale off of steel plate. Why not the same thing for dishes? So he devised a jet unit that works like a rotary lawn sprinkler. It really de-scaled dishes.

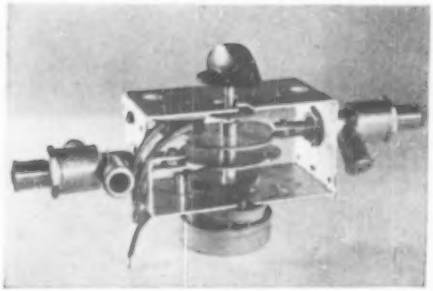
Another fault he had to find with available dishwashers was that they only washed the fronts of the dishes by direct action. The backs got washed only by the rebound of the water. When a housewife stacks her dishes at the end of a meal, the backs get a lot of food on them. Often it dries there. La Raus met that problem by canting his jets in such fashion that they hit the dish backs, too—and at the same time, by jet reaction, slowed the rotation of his washing-unit arm so the water would do a de-scaling job.

He considered the problem common to everybody who rents a house or an apartment. Many dishwashers had to be hooked up permanently to a water source with plumbing. Why make a gift to the landlord? So he decided that he would connect his tub to the kitchen faucet with detachable rubber hose. And that led right into the problem of independent water pressure. He had to have a pump.

He experimented. Now he was in trou-



Detachable water-inlet hose and dirty-water discharge hose that hooks on sink make washer portable. One simple screw-on fixture for faucet is all that is needed for sink connection. Washer uses only 3¾ gals. of water at normal hot temperature to clean up after meal for five.



Control unit has clock-type electric motor geared for one revolution in 15 minutes. Cam followers operate two valves shown. Cycle is inlet of washing water, outlet of dirty water, inlet and outlet of two rinse waters.

Tub and lid are made of Fiberglas®, which will not mar, chip, or discolor. Cabinet is steel with baked-enamel finish. Drain sump in bottom has a strainer to catch solids that might clog hose. Strainer must be emptied from time to time.

ble. Most pumps were noisy. Some rubber-bladed pumps wore out. Gear pumps jammed when food got into them. Then he remembered—the bilge pumps on boats got rid of dirt and corrosion without jamming. He chinned with the Eco Engineering Co., of Newark, N. J., makers of bilge pumps.

"We can build you a pump if you'll help us," said Eco. He did. He worked out a pump of the rotary-displacement type, concentrating on nonclogging design and wear-resistant materials. The pump was so successful that today it's being used by the chemical and other industries.

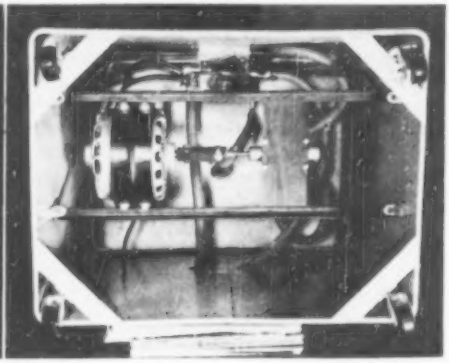
La Raus hadn't whipped all his problems by a long shot, but he was well on his way. He designed a simplified control that would run through the wash-rinse cycles without further attention. All a wife has to do is put in the dishes, add a detergent, and close the lid. The washer shuts itself off when the dishes are done. Then she lifts the lid and even the glasses dry to a sparkle.

The washer, rolling on large casters and weighing only 100 pounds, is portable. Load it into the family car and tote it off to your summer place if you want to.

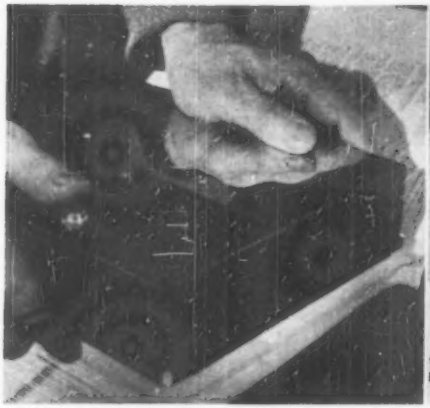
La Raus had no idea what he had let himself in for when he started designing a dishwasher. But today, four years and some 75,000 knives, forks, and dishes later, he has the washer he wanted. Apparently it's what other husbands want, too: today his American Dishwasher Co., of New York, is up to its ears in orders.

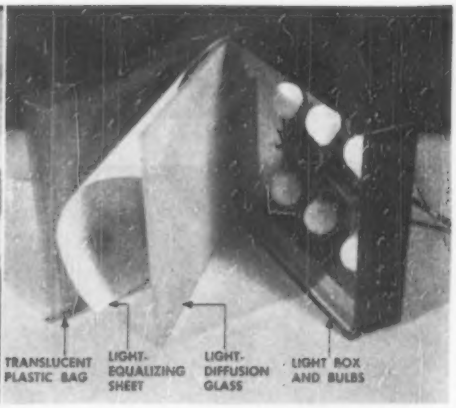
It paid off in another way, too. He doesn't have to help with the dishes any more. END

Racks are plastic-covered to cushion dishes and glasses. Silver nests in center. Plastic coating provides rust-proofing as well as protection against chipping of dishes. Sole manual operation is lifting lid to let dishes dry.



Pump motor is 1/6 hp. Valves in control unit are self-balancing type that will operate easily against any normal house water pressure. Controls, motor, and pump assembly are mounted in rubber to eliminate almost all vibration.



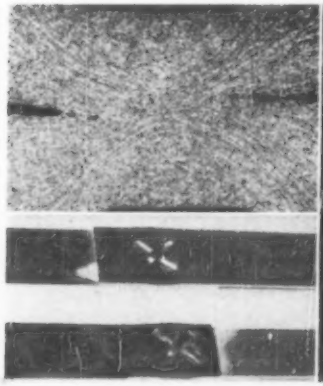


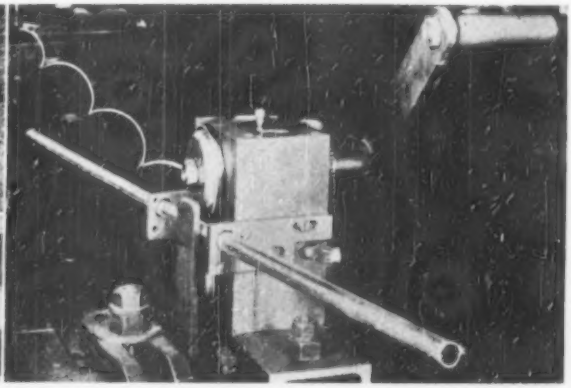
"Cigar Box" Copies Anywhere

THIS cigar-box-sized photo-copier is so compact and simple it can be taken right into a library. You just put a sheet of sensitive paper down on the page you want, set the box down on it, press a button—and you've made a reversed negative copy, ready for development.

A special equalizing sheet, which permits even lighting from bulbs very close to the paper, makes the small size possible. No special stand is needed to flatten curved surfaces, such as bound pages, because an inflated, translucent cushion forms the lower face of the copier, holding the paper flat against curves.

Invented by Frederick G. Ludwig of Yale, the Contoura® can be used with AC, DC, or flashlight batteries. A mirror on the box permits a reversed negative print to be read directly. Positives need a second exposure.





Squeeze Welds Metals Cold

IF YOU squeeze two metals together in just the right way, the British have discovered, they'll stick—just as if they had been welded. No heat is required and relatively little pressure—about 20 tons per square inch on a very small area. This can be applied by a small, hand-operated press (right above). Under this pressure, the metals "flow" together, forming a seamless bond (top left). At bottom left are strips of sample welds.

Secret of the process, now introduced in this country by the Koldweld Corp., of New York City, is the shape of the tool or die used to press the metals together. This must be just right and different for each metal. Even dissimilar metals can be joined so long as the proper-shape die is used for each. Among the metals that have already been successfully welded in this way are aluminum, copper, nickel, zinc, and silver.

Radiac Spots Atom-

By Herbert Johansen

PS photos by W. W. Morris

Radiac is carried over the shoulder by a plastic strap that is washed with soap and water after having been exposed to radiation. Push button on top lights scale for night reading.

ATOMIC explosions can be detected at great distances by various sensitive and delicate instruments, including Geiger counters. But in the event of an atom-bomb attack, other types of equipment would be needed, rugged enough to stand up under field handling, and able to measure high amounts of radiation without becoming "saturated" and inaccurate.

We now have such an instrument. It's called a "radiac." Developed by the Signal Corps Engineering Laboratories, it's now being used to train soldiers in the science of detecting and measuring the heavy radiation that would result from an atomic-bomb blast.

Radiac is a coined word standing for "radioactivity detection, identification, and computation." The unit devised by the Signal Corps for seeking out gamma rays, one of the most dangerous types of atomic radiation, uses an ionization chamber instead of a Geiger-Müller tube.

Development of the radiac was sparked by the fact that most devices available today to measure and detect atomic radiation (PS, May '49, p. 166) are built for labora-

Scale at top of the unit is graduated in milliroentgens of radiation per hour. The knob on right selects one of five different sensitivity ranges between 0-5 and 0-50,000 milliroentgens.

Blast's Killer Rays

tory, medical, or industrial use, under controlled conditions. As a result, they are too delicate and sensitive to be used by military teams or civilian-defense units. The Geiger counter, for instance, is so sensitive that when exposed to high concentrations of radiation, it saturates and jams, giving false readings. For high-intensity radiations, ionization chambers are better than Geiger-Müller tubes, but until the radiac was developed, even they were too delicate.

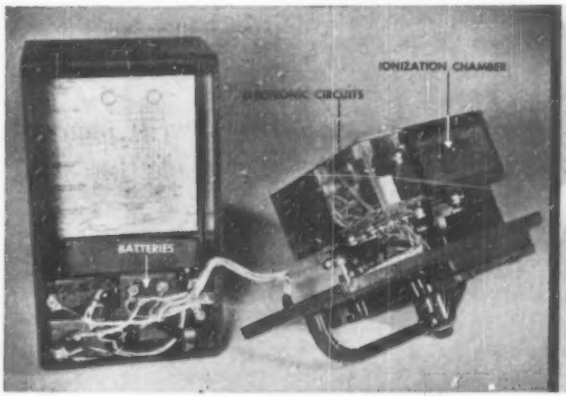
The radiac is a compact instrument enclosed in a steel case, measuring 10 by 6 by 5 in. and weighing 10 pounds. It is carried over the shoulder by a special plastic strap. (Webbing or leather can't be used because they retain contamination.) The set is specially designed to stand up under shock and vibration, and is easily repaired in the field.

Heart of the set is the ionization chamber. It is made of high-carbon-content plastic, with an Aquadag® (graphite suspended in an adhesive) coating on the inside. This forms an outer, positively charged electrode. A wire loop within the chamber is the negatively charged electrode. A potential of 180 volts is applied across the two.

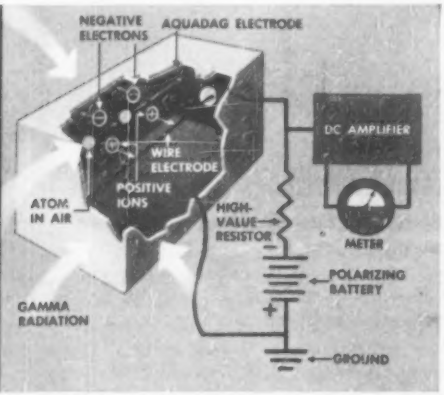
Gamma radiation, piercing the chamber wall, knocks electrons from the atoms in the air within, which then become positively charged ions. Because of the potential in the chamber, the Aquadag walls capture the negatively charged electrons that have been knocked loose, while the wire loop attracts the positive ions. As a result a minute current flows through the chamber. This is greatly amplified and read on a meter as milliroentgens of radiation per hour.

A roentgen is the unit by which human exposure or tolerance to radiation is measured. A milliroentgen is a thousandth of a roentgen. The radiac will measure up to 50,000 milliroentgens per hour. This is 1,000 times the intensity that can be measured with most Geiger counters, and would indicate an area that should be evacuated.

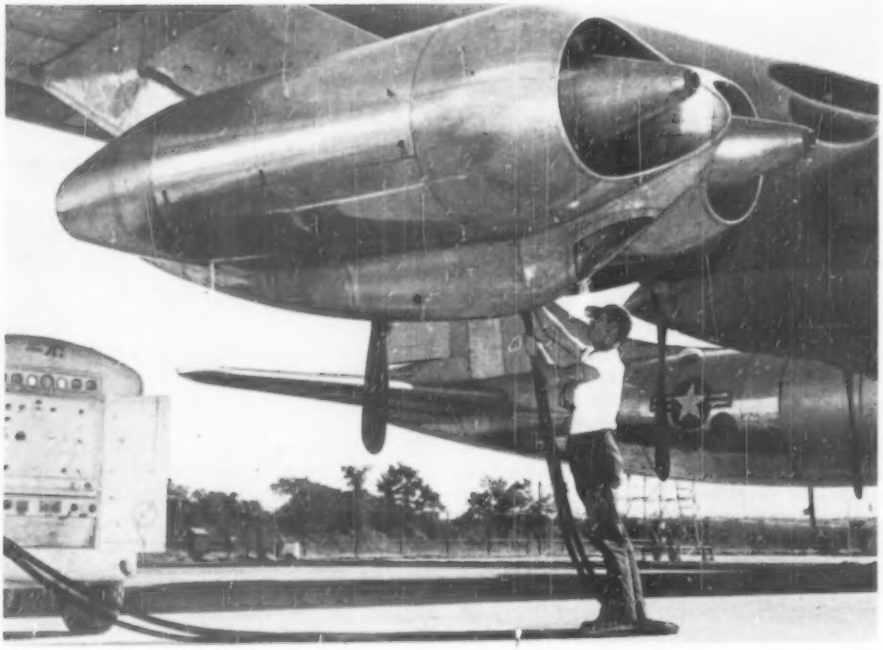
Fred C. Dixon, project officer under whom the device was developed at the Evans Signal Laboratory's new nucleonics division, near Fort Monmouth, N. J., pointed out that the present ionization-chamber radiac is a training device made to Army specifications to teach military personnel the use of such equipment. The unit was designed, however, with the requirements of civilian-defense organizations in mind. Manufactured in quantity, it could probably be sold for around $250. END



Top of the radiac can be lifted off by the handle after removal of two hold-down screws. Wiring diagram fitted in back of box at left enables trained personnel to make field repairs.

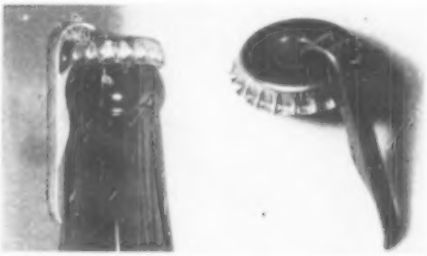


Simplified diagram above shows how radiac works. Gamma radiation (arrows) striking the ionization chamber at left is converted into electrical energy, amplified, and read on a meter.



Jet "Pods" Boost B-36 Speed

STILL more powerful than the jet engines originally slung under the wings of the B-36, these J-47 engines add more than 20,000 pounds of thrust to the 21,000 hp. developed by the giant Convair bomber's six reciprocating pusher engines. There are four of the jet units mounted in pairs in pod-like housings under the Air Force plane's outer wing panels. Above a mechanic is plugging in the electric power to start the jets.



Bottle Has Built-in Opener

WHERE'S that doggone bottle opener? How many times have you said that at home or at picnics? All too often, thinks O. S. Johnson, of Bellflower, Calif. So he invented the handy gadget shown above. With it, every beverage bottle would have its own opener. It is attached to the top of the cap so it can pivot (right), and its prongs are slipped under the edge during capping (left). The opener is discarded with the cap.

Elevator Gets a Cockpit

FROM a raised compartment, this elevator operator has a clear view of the extra-wide door. Electric eyes above the entrance also keep the door from closing on passengers. Four such Westinghouse elevators installed in Boston's Jordan Marsh department store use wire recording to announce floors.

Boomerang Makes Comeback

THE youngster at right above is being shown the proper position for hurling the Boomer-Wing®, a new toy invented by an Akron, Ohio, man, Robert Kerr, as a safe adaptation of the ancient boomerang. It consists of a rubberized plastic "wing" that fits into a slot at the end of a casting arm, as seen in the photo. Describing it as a game of skill, the inventor claims the wing will soar more than 100 feet and return to the thrower—and won't even break a window en route if the throw is miscalculated. It is made by Brittain Products Co., Akron.

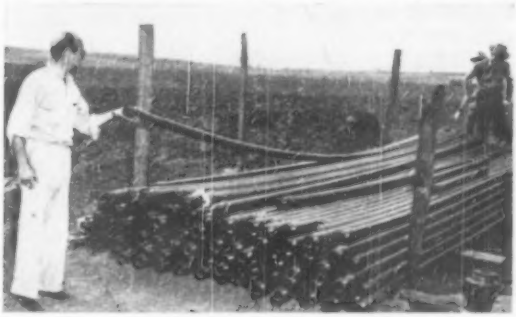
'Copter Flies "No Nothing"

"NO HANDS" helicopter flying is old stuff. In this unique photograph, the pilots have climbed completely out of the cockpit of their Hiller 360 and are clinging to the engine compartment. The 25-mile pilotless demonstration flight, made 3,800 feet above San Francisco Bay, was intended to show the stability of the Hiller Rotor-Matic® system of control (PS, Feb. '48, p. 125).

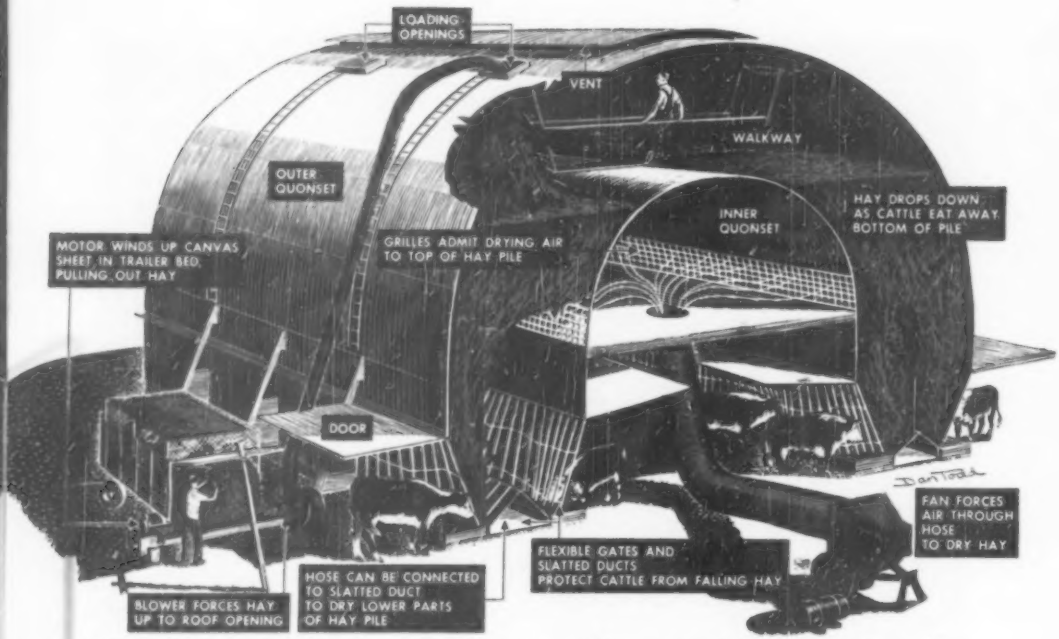
Capsule Holds Lighter Fluid

A TWO-INCH, unbreakable gelatin container of lighter fluid, familiar to GIs stationed in England, has been introduced in this country. Besides filling lighters, the capsules, called Tyesule Rikkies®, clean clothing, eye glasses, and typewriters. One end is pierced with a pin and the liquid squeezed out. The capsules sell for 5 cents apiece.

New Plastic Pipe Is Light and Flexible



THE man at left easily picks up a 20-foot length of Tenite® pipe with one hand. Made of cellulose acetate butyrate plastic, the pipe is only one-twelfth the weight of cement-lined steel tubing ordinarily used by the oil industry in drawing salt water from crude-oil deposits. Another feature of the new noncorrosive tubing, called Carlon B®, is that it is flexible enough to follow the contours of the earth when laid above ground.



Self-feeding barn is actually two quonset huts, one inside the other. Space between holds 80 tons of hay, a winter's supply. As cattle eat away bottom of pile, more falls down from above.

Barn Feeds Cattle Like Cafeteria

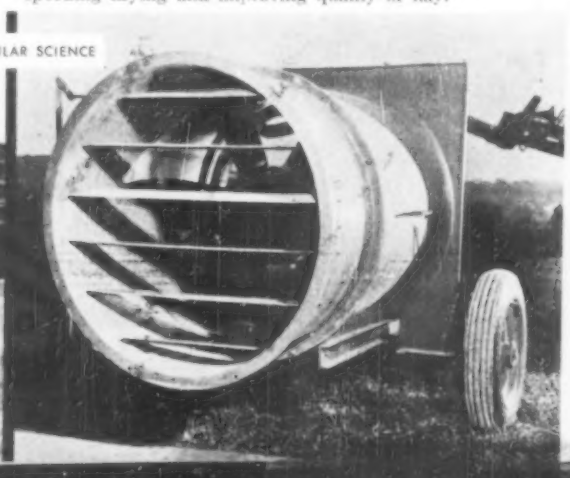
Photos by Prof. Harry Besley, and W. W. Morris

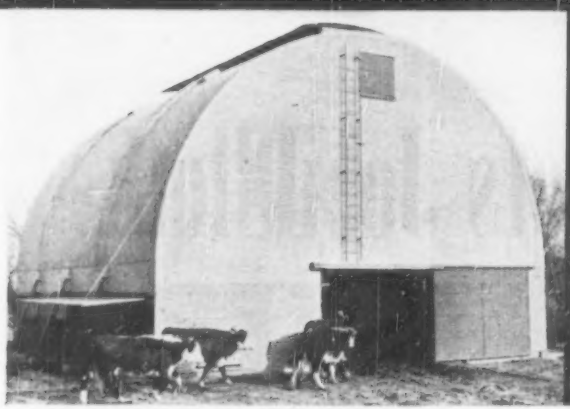
PAUL M. MAZUR is one of those lucky farmers who don't have to worry about getting out on a nasty winter day to feed their stock. Partner in a New York banking firm and director of half a dozen corporations, he employs four men to work Fiddler's Creek Farm, his New Jersey country home.

But Mazur is also an expert on how to do things efficiently. His book on the organization of retail stores is a standard work in

Machines do all the work of putting hay into barn. Canvas sheet under load in bed of trailer winds up like window shade, pulling load off and into blower that forces it up to opening in barn.

Experimental engine-driven fan completes drying of hay after it is in barn. Waste heat from engine is used to warm air that fan blows, speeding drying and improving quality of hay.





"Cowfeteria" looks like ordinary barn from outside. Cattle can eat whenever they want so long as feed-bin doors are open (outside doors are visible at left; similar ones are inside).

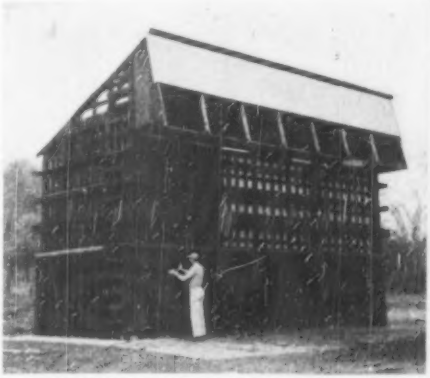
Gates to keep cattle from crawling under hay pile are timbers, spaced few inches apart, hinged at top, and connected by chains. Inverted-V air conduit (far left) also helps keep cattle out.

that field. And when he became a farmer, he rebelled at the idea of "paying $1.50 an hour to two-footed men to serve meals to four-footed animals."

So he has worked out, in cooperation with the Agricultural Experiment Station of Rutgers University, methods that practically eliminate human labor from the job of feeding cattle—methods any farmer can adapt to his own needs.

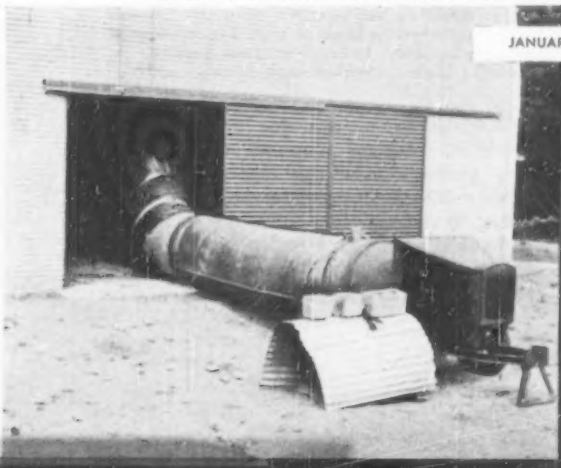
Most unusual result of the work is the "self-feeding" barn. It lets cattle eat as much as they want, whenever they want—without anybody having to pitch hay to them. A similar self-feeder has been built into a silo and is being tested this winter.

The scope of Fiddler's Creek project isn't limited to special equipment. It is an all-around attempt to find how to get the most out of hilly or stony acreage through "grassland" farming—turning grass into meat. END



Timber that locks door of experimental silo against heavy pressure of its contents is replaced by farm-manager Robert Barnhart. Silo is made in four sections, each lined with paper. Paper is sealed at top to prevent air from spoiling silage. Self-feeding design works like that of barn.

Fan blows drying air through the hay with help of huge hose connected to special openings in storage bins. Photo at right below shows hose connected to one of two wood-slat conduits that run length of barn at ground level. They dry the lower parts of the hay. At left below, hose is connected to ceiling opening that circulates air through the upper parts of the hay.



Gun Shoots Jet Pilots

1. Pilot slips feet into footrests, holds elbows in close. For demonstration, flyer here wears full jet-pilot equipment, but trainees take ride in ordinary clothing. In actual cockpit, special disconnecting arrangement makes it unnecessary for pilot to fiddle with "spinach" (connections).

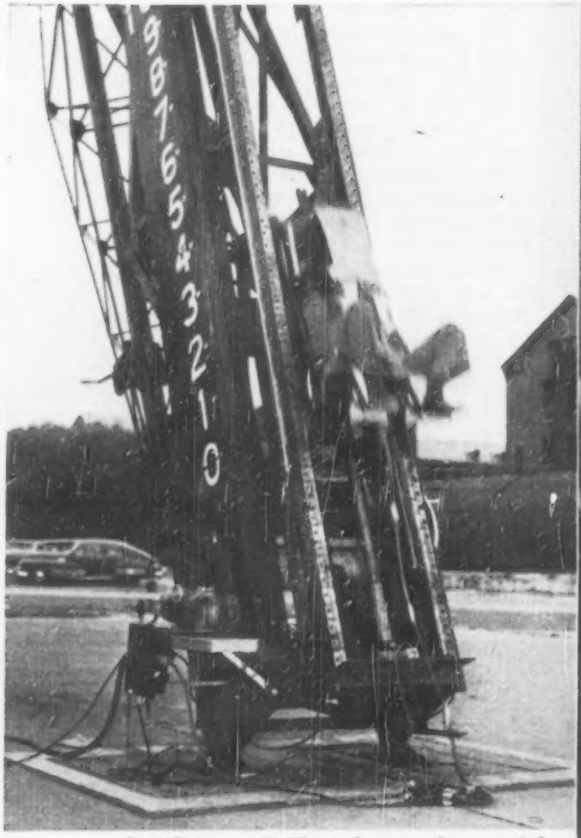
2. To eject himself, pilot reaches overhead and jerks curtain down over his face. A cable fixed to the handles on mask triggers "gun" attached to back of seat. The mask is to protect his face from slip-stream blast as he emerges from cockpit at high speed.

PS photostory by Hubert Luckett

ACROSS the top of this page a Navy jet pilot is shown receiving the world's swiftest kick in the pants. Boosted by a special 37-mm. cartridge, he hits almost a mile-a-minute clip in a fraction of a second as he soars 45 to 50 feet up the steel tower.

But this super-thrill ride may save his life if his jet plane ever fails in flight. For he's gaining knowledge about—and confidence in—the ejection seat that he must count on to throw him out of the cockpit of a doomed plane. One instant of hesitation then might mean the difference between life and death to a jet pilot hitting 600 m.p.h.

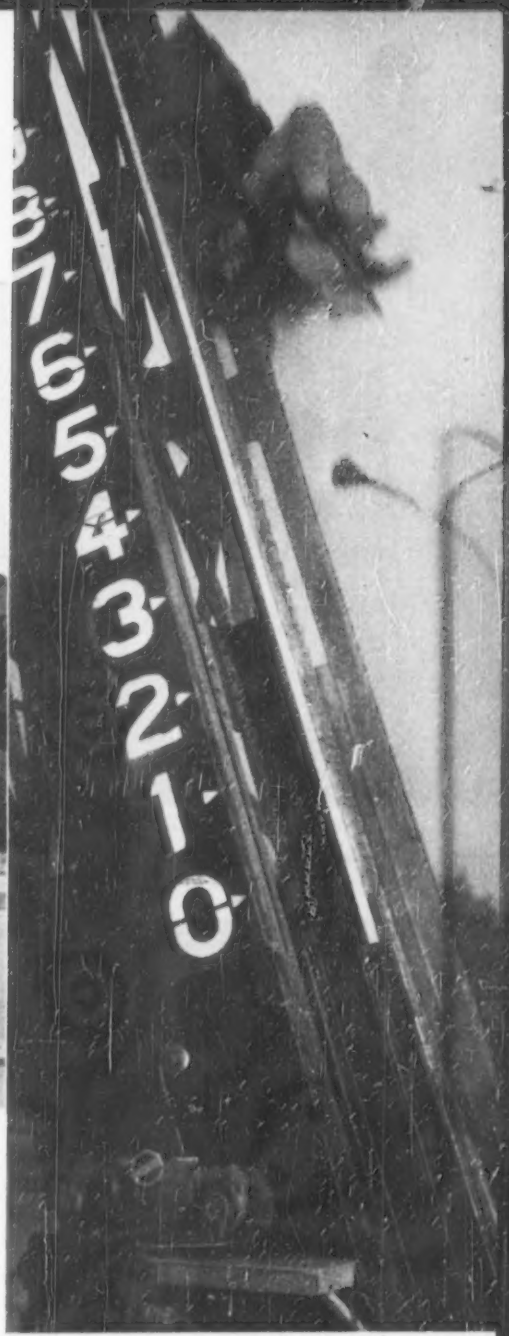
Up Slide



3. "Going up!" This indoctrinee has traveled about two feet up tower. The "gun" or catapult, consisting of piston inside cylinder about three feet long, can be seen just below seat. Cable uncoiling in front of tower connects to instruments that record ride.

That's why every week a fresh batch of Navy fleet and test pilots comes to the Naval Air Material Center at Philadelphia to take a trip on the Aeronautical Medical Equipment Laboratory's souped-up thrill ride.

Whether they will admit it or not, even the most seasoned pilots are a little nervous about sitting on a 37-mm. cartridge and



4. The worst is over now. By time rider is three feet high, he has reached speed of about 50 m.p.h. Cylinder attached to seat has now pulled free of stationary piston. Instrument cable, seen falling away, disconnects since only forces acting now are friction and gravity.

At the top of the ride the seat is held by a ratchet until a winch line is connected to it to lower it slowly to the ground. Average ride for indoctrination is about 45 feet.

deliberately firing it to see what will happen.

For it's no joke to be boosted to a speed of around 50 miles an hour in the space of about three feet. When they are told that the force on them will amount to around 15 G, they are really worried, since they know that about all a man can stand without blacking out in a high-speed pull-out is three or four G. The answer is in the brief duration of the stress. The ride is all over in two-tenths of a second as far as acceleration is concerned. The peak stress of 15 G lasts for only 1/100 of a second. For the rest of the trip, the pilot is gradually slowing down due to gravity, air resistance, and friction.

Most important in making the trip with no unhappy results is making sure that the pilot is in the proper position in the seat before the catapult is fired. The engineer in charge carefully checks his posture and the seat belt and then steps quickly to a point directly in front of the tower to line up the head position. When he is satisfied that the head is directly in line with the spine, he counts three, the passenger yanks the face curtain down, and it's all over before you—or he—can blink an eye. The counting is important. It relieves nervous tension and avoids the possibility of "buck-fever."

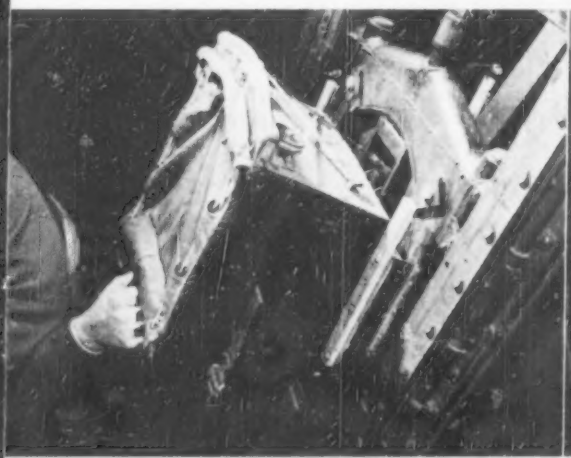
Experiences vary, but on two points the trainees are unanimous: anticipation was much worse than the actual ride, and it gave them so much confidence that they would never hesitate to use their ejection seats.

Specially made 37-mm. powder cartridge is loaded into cylinder that is then put in place on back of ejection seat. The cap to the right carries firing pin and trigger mechanism.

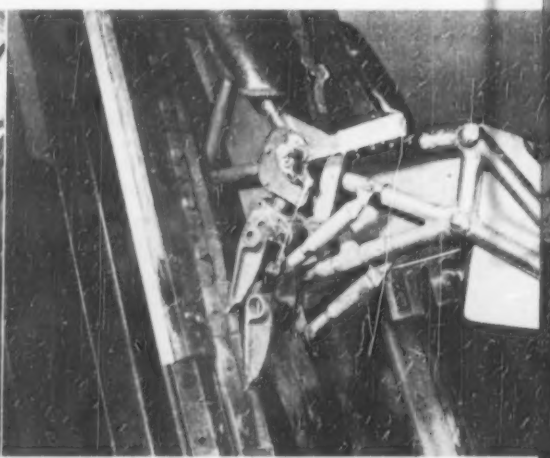
The instrument cable plugs into socket on the bottom of the seat. It connects to recording oscillograph on ground that records pressure in gun barrel and acceleration rate of seat.

The 105-foot steel tower at Naval Air Material Center, Philadelphia, was originally built to aid in designing ejection seats. It is now used as part of indoctrination of Navy jet pilots.

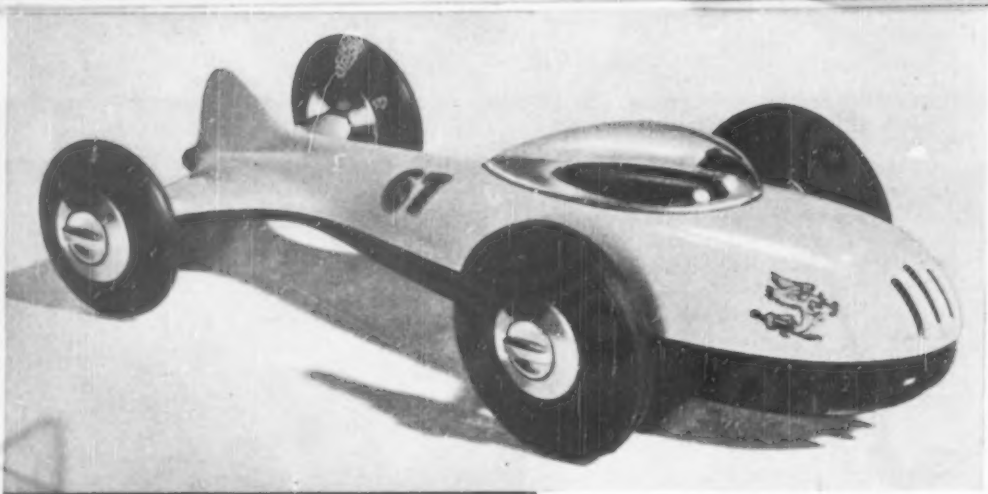
Technician fits piston into charge-loaded cylinder on seat. Rings similar to auto piston's make effective seal with cylinder walls. Hand wheel operates winch to raise and lower seat.

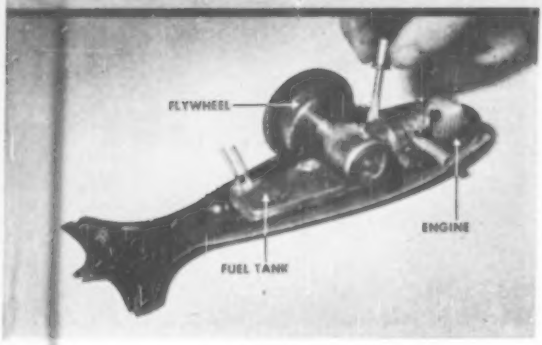


When not in use, face curtain is held out of pilot's way by elastic cords. Cable connecting handle to cam arrangement on gun fires gun when mask is pulled all the way down.



Ratchets on track and pawls on seat hold seat at top of ride until winch line can be attached to lower seat to ground. Winch line, dropped from top of tower, couples to seat automatically.





Diesel Powers Model Racer

A REAL Diesel engine that weighs only six ounces drives this tiny racer 60 m.p.h. Give it a push to start it and it then keeps running without any electrical system.

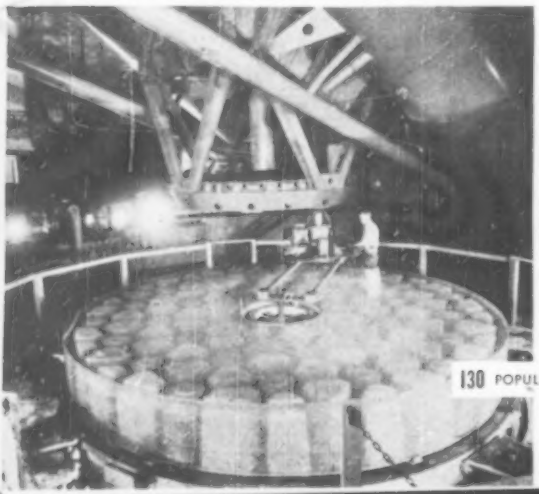
Using a special fuel of ether, castor oil, Diesel oil, and kerosene, the small two-cycle Diesel operates at a compression ratio of only eight-to-one, just slightly above that of passenger-car gasoline engines. The entire 11-inch-long car, called the Challenger® by its makers, A. L. Maxey Mfg. Co., Burbank, Calif., weighs only 2½ pounds.

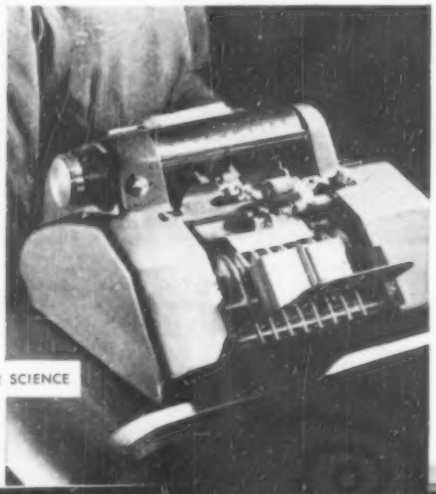
Big Eye Gets Final Polish

IT TOOK five months to put in the last few licks of polishing on the world's biggest eye, the 200-inch glass mirror for the Hale Telescope on California's Mount Palomar. Actually, only seven hours were needed to polish off the few millionths of an inch here and there that had distorted its surface—tests took the rest of the time. The photo below shows the huge glass just before application of the aluminum mirror coating.

Machine Counts Money Fast

THIS machine can count 1,000 currency bills a minute and never make a mistake. Its trip mechanism is so sensitive that it once spotted a counterfeit bill while checking department-store receipts—the phony was a shade too thick. Called the Tickometer®, it is made by Pitney-Bowes, Inc., Stamford, Conn., for counting all sorts of small paper items. It can also stamp dates or codes on them as it counts.





Fire Rescue Suit Defies Inferno

THE man at far left above is going to a fire dressed in the first protective suit designed by the U. S. Air Force to permit actual entry into the flaming wreckage of a crashed aircraft. In the second photo you see him walking into a searing 2,400° fire. After a minute and a half he comes out in good shape, as seen in two right photos. Darkened areas of the suit show where outer, abrasion-resistant "sacrifice" layer has disintegrated, leaving intact an inner layer that is just as fire-resistant as ever. In a fire of 2,000° he could remain for 10 minutes before his body temperature would exceed a safe 115°. Tests show that three minutes in flames are enough to rescue crash victims.

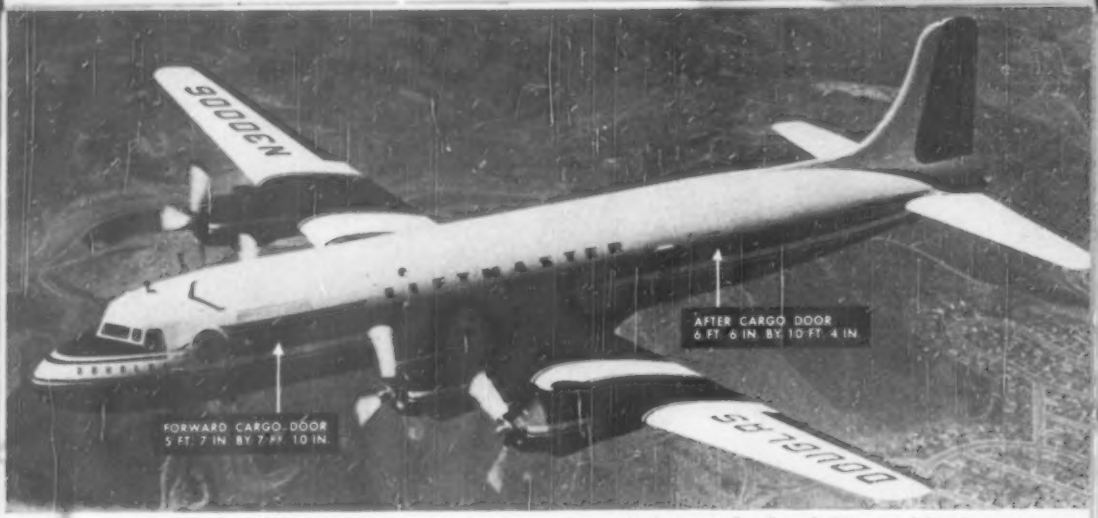
The 29-lb. suit is made of 18 layers of glass fiber, glass-fiber batt, glass-fiber net, neoprene-coated glass fiber, honeycombed cotton cloth, silver foil, aluminum foil, and nylon. As the outfit is completely enclosed, the fireman breathes from a compressed-air bottle strapped against his chest. He carries a blanket of the same material as the suit to wrap around victims. Earlier suits made of aluminum foil laminated on glass cloth protected against radiated heat but were not safe against actual flames.

Bus + Truck = Bruck

FROM the front it looks like a bus; from the rear you'd think it a truck. It's both. Made by Kenworth Motor Truck Corp., Seattle, Wash., the Bruck® carries 17 passengers in front, and a sizable load of freight in the rear compartment. The freight section is 18 ft. long, 7 ft. wide, and 8 ft. high. The vehicle was designed for service in northwestern U. S., where both buses and trucks often run lightly loaded.

Curb Guard Saves White Walls

CURB scuffing isn't so likely to mar the appearance of this new white-wall tire. A rubber rib around the outer edge of the white section makes contact first. As pressure is exerted against the rib, the white wall flexes inward—away from the curb. The scuff guard is a feature of U. S. Rubber's Mid-Century Royal Master®. The low-pressure tire also has a new tread that is said to reduce the need for chains on snow and ice.



The Douglas Liftmaster cargo transport is five feet longer than the DC-6 passenger air liner from which it was developed. The aerial freighter has more powerful engines, greater speed.

Cargo Gets Own Air Liner

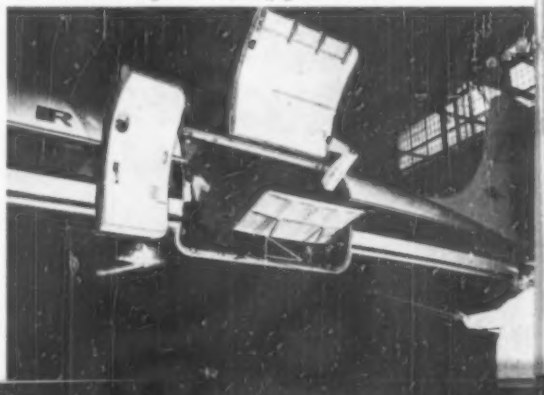
PS photos by W. W. Morris

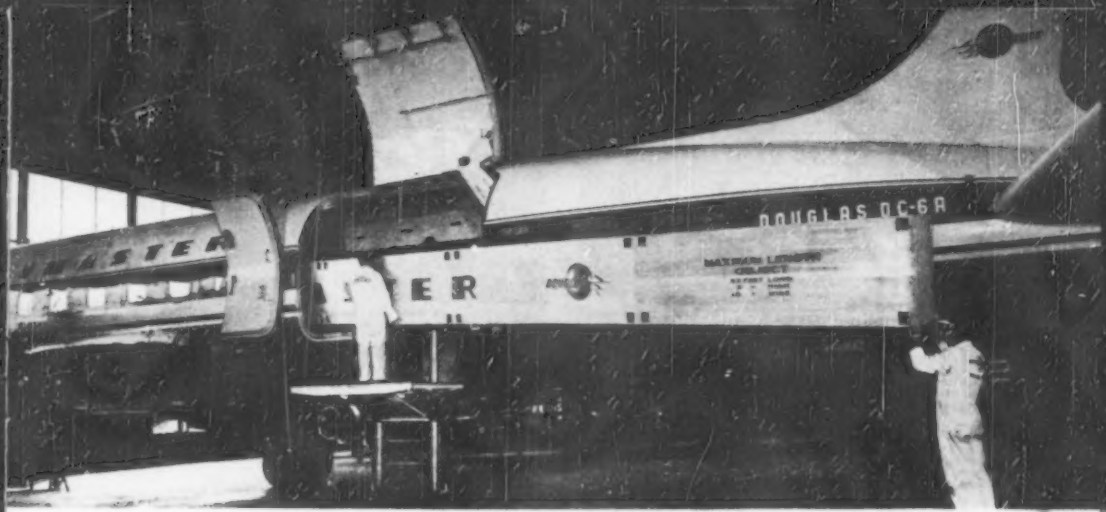
MEET the Liftmaster, freight-hauling big brother of the DC-6 luxury air liner. Douglas Aircraft engineers designed the new ship around cargo—its weight, bulk, loading problems. Result: the first postwar commercial transport tailor-made for high-speed, long-range, low-cost carrying of air freight.

Its four more powerful Pratt & Whitney engines, each with 2,500 hp. available for take-off, give the DC-6A an average speed of 320 m.p.h. Coast-to-coast nonstop, it can carry a payload of 24,000 pounds. Completely pressurized, the Liftmaster flies above 20,000 feet, and an air-conditioning system permits it to haul perishable cargoes. Reversible-pitch propellers permit short landings. Two huge cargo doors, one forward and one aft, are hydraulically operated and swing upward to be clear of loading equipment. Other features are a power lift, radiant heating, and a waterproof floor that can be cleaned by water-flushing.

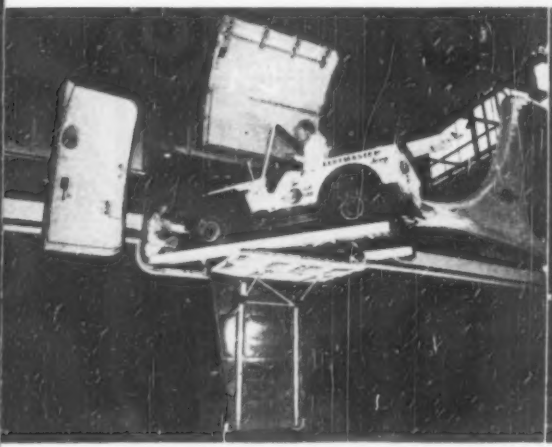
Jeep drives up portable ramp attached to lift platform. Crew chief standing in the plane's doorway is holding remote-control box that operates the electrically driven loading device.

When cargo has been loaded, the lift platform is raised into the plane by hoists using the same power that operates the elevator when in use. Man at lower right is holding guide cables.





Dummy box being loaded above shows that huge after door can handle a single package 52 ft. by 3 ft. by 1½ ft. Crewman in the center stands on platform of powered loading elevator.

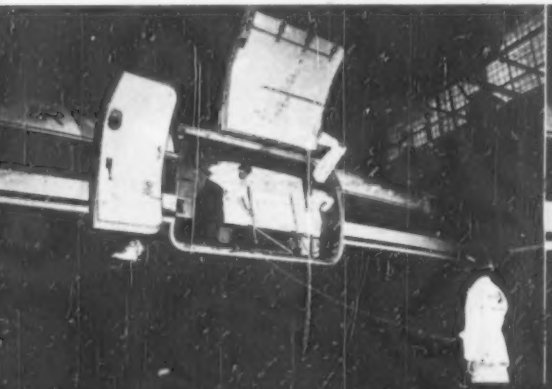


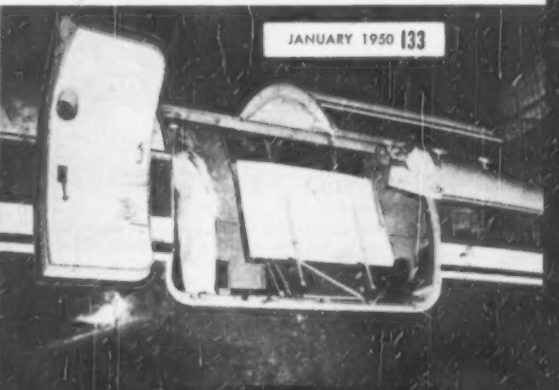
Up goes the jeep. When it reaches cargo-floor level, a crew member swings the swiveled ramp so that the vehicle faces into the plane. The hoist has a lifting capacity of 4,000 pounds.

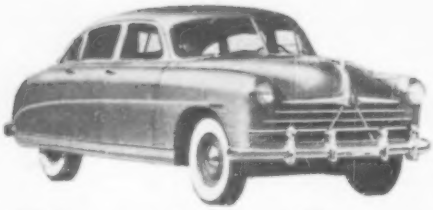
Crew chief signals the jeep to drive in. The vehicle was carried along for ground transportation of crew and technicians on a recent nationwide demonstration tour of the Liftmaster.

Unhooked from bottom of cargo doorway, the lift folds neatly for stowage inside the plane. The device is for use at airports that do not have adequate cargo-loading facilities.

Main section of after cargo door is lowered hydraulically. The lift platform, shown in stowed position, is portable, and can also be used for loading through the plane's forward door.





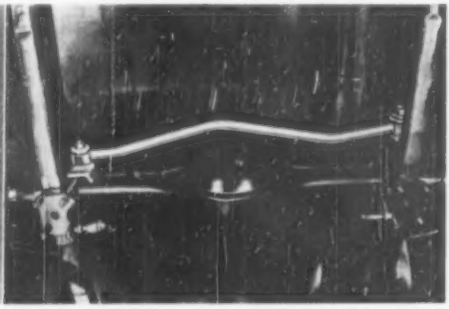


Hudson Introduces Shorter, Lower-Priced Car

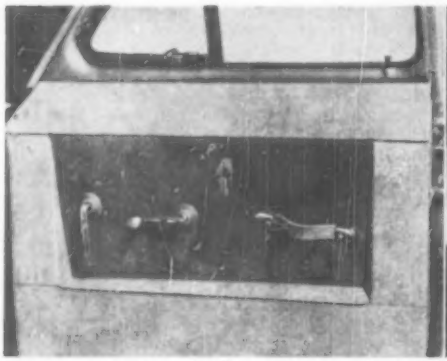
IN A BID for more business in a lower-priced field, Hudson has introduced a shorter automobile costing about $250 less than the cheapest of its bigger cars. It's still around $400 more than the Big Three makes. Called the Pacemaker, the new Hudson has a 119-inch wheelbase compared with 124 inches in the company's standard series. Most of the shortening is in the hood. This increases the driver's road visibility. The car boasts a 758-square-inch windshield. Hudson's exclusive step-down design gives an over-all height of only five feet.

The Pacemaker's 112-hp., six-cylinder engine has a compression ratio boosted to 7.2 to 1. In keeping with the trend toward automatic transmissions, the company offers optionally what it calls Super-matic Drive®. It shifts gears automatically and doesn't "creep" at red lights.

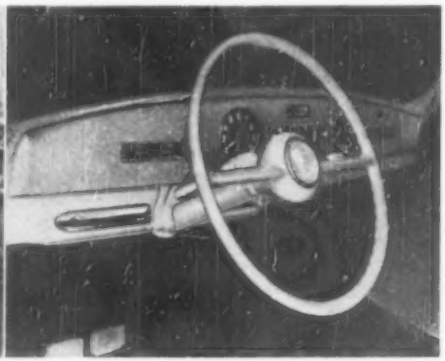
Pacemaker series has "fluid-cushion clutch"—shown cutaway—for smooth getaway, soft pedal action. Engine bore is 3 9/16", stroke 3⅝".



Driving safety, riding comfort are increased by use of this rear lateral stabilizer. Another stabilizer, in front, holds down sway.



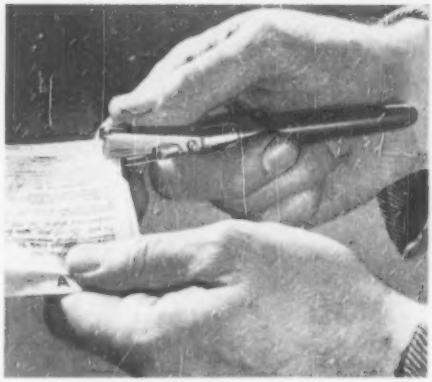
Two extra inches of elbowroom are afforded by recessing interior door panels as shown here. Assist strap aids in pulling the door shut.



Instrument panel has a simulated-fabric finish. Lower edge of righthand side curves upward to give extra knee room to front-seat passengers.

Pump Inflates Arctic Hut

THREE minutes on a hand pump blows up a bundle of cotton cloth into a four-man baby quonset hut, shown above, that can stand up under 100-m.p.h. icy gales. It was developed jointly by the Air Force's Aero Medical Laboratory and the U. S. Rubber Co. for air crews downed in the Arctic. The hut, four feet high, seven feet wide, and nine feet long, is made of two-layer cotton fabric coated with a low-temperature neoprene compound that withstands extreme cold. Air between the layers, at as little as a pound and a half pressure, makes internal braces unnecessary and provides insulation. Ventilation is supplied by a 10-foot air hose, seen at far left, that can be snaked along the ground to keep out direct wind blasts.



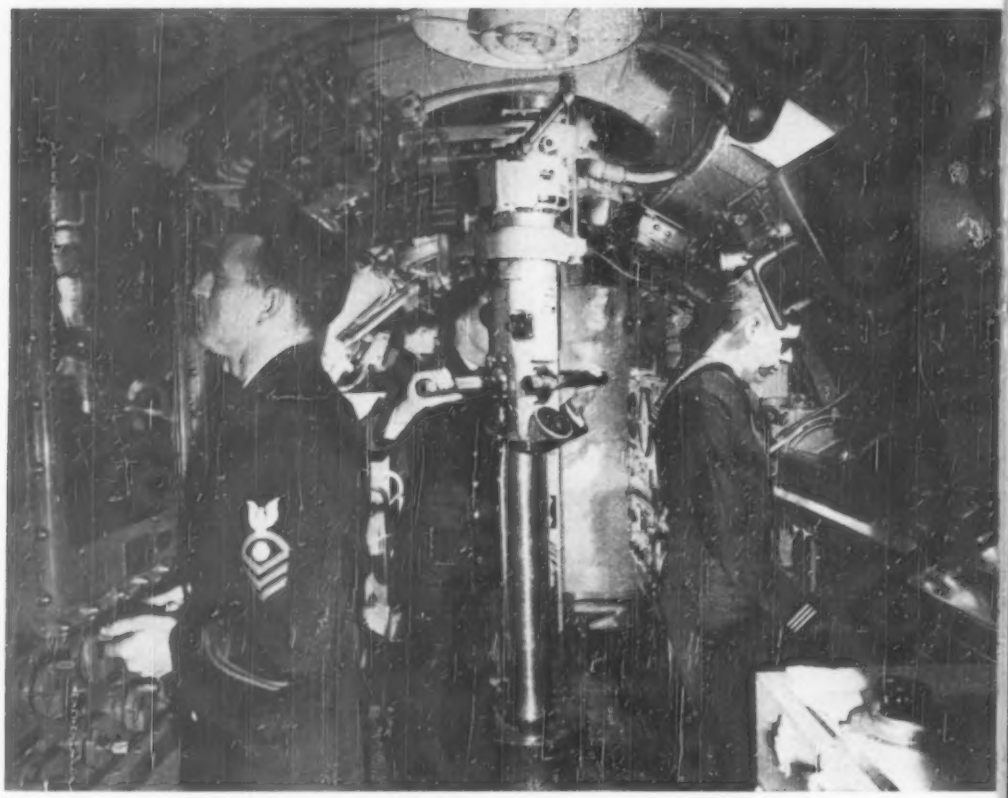
Stapler Clips to Pocket

THIS new pen-size Duo-Fast® paper fastener, for traveling businessmen or home use, will staple up to 16 sheets securely. It's only five inches long and weighs 1½ ounces.

With its cap on, it can be carried conveniently in your pocket like a fountain pen. One hundred staples fit into its plastic barrel, which comes in five different colors. The cap and stapling mechanism are made of chrome. Manufactured by the Fastener Corp., of Chicago, Ill, the pocket stapler sells for $2.95 with 1,000 staples.

Aerial Truck Lugs Own Weight

THE new Chase Avitruc, shown above on its first flight, can carry a cargo load greater than its own empty weight of 25,000 pounds. The C-123 was designed for the Air Force to transport heavy combat equipment for troops in forward areas, often lacking prepared landing fields. Note the big rear loading ramp, shown at left with a half-track backing in. The plane can also haul 60 fully equipped soldiers. Two 2,400-hp. engines give it a top speed of 250 m.p.h.



"Up periscope. There she is—bearing 255, range five miles. Down scope." Above, student officers see target ship, give real orders, and carry out attack maneuver exactly as if at sea, in realistic conning tower of dry-land submarine. Their computed firing data show torpedo hits scored. Below, the instructor watching them has panel telling target's actual course.

Dry-Land Sub

U. S. Navy's undersea sailors learn attack maneuvers and get torpedo practice on indoor target range.

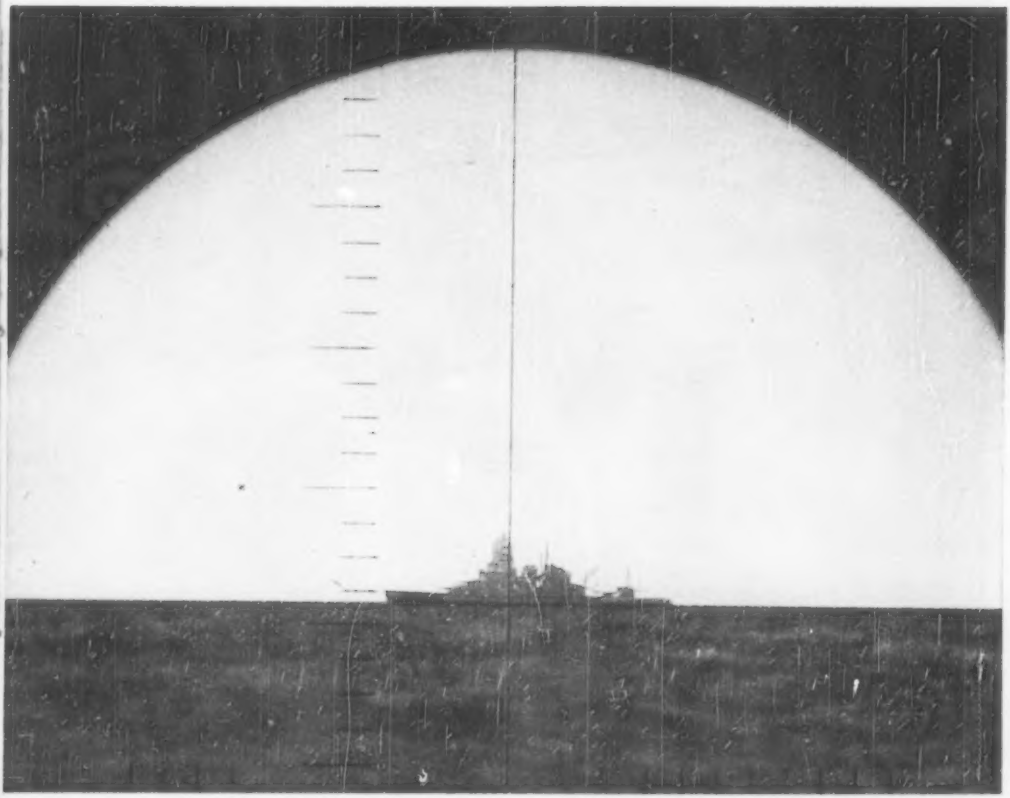
By Alden P. Armagnac

PS photos on location by W. W. Morris

"SURFACE ship sighted, sir! Bearing 250 degrees. Range seven miles."

The scream of the klaxon summons all hands to battle stations. Submerging, the submarine closes upon its prey.

"Up periscope!" Briefly the slender tube breaks water, every few minutes, just long enough to get a new bearing and range. Now the target ship is only 2,000 yards dis-

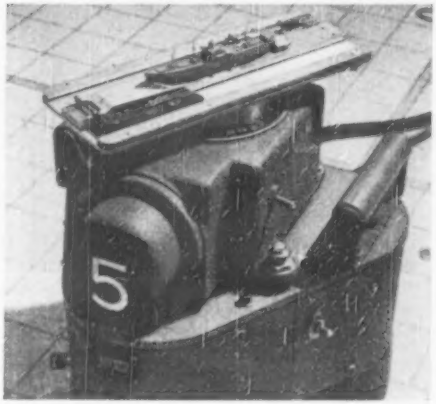


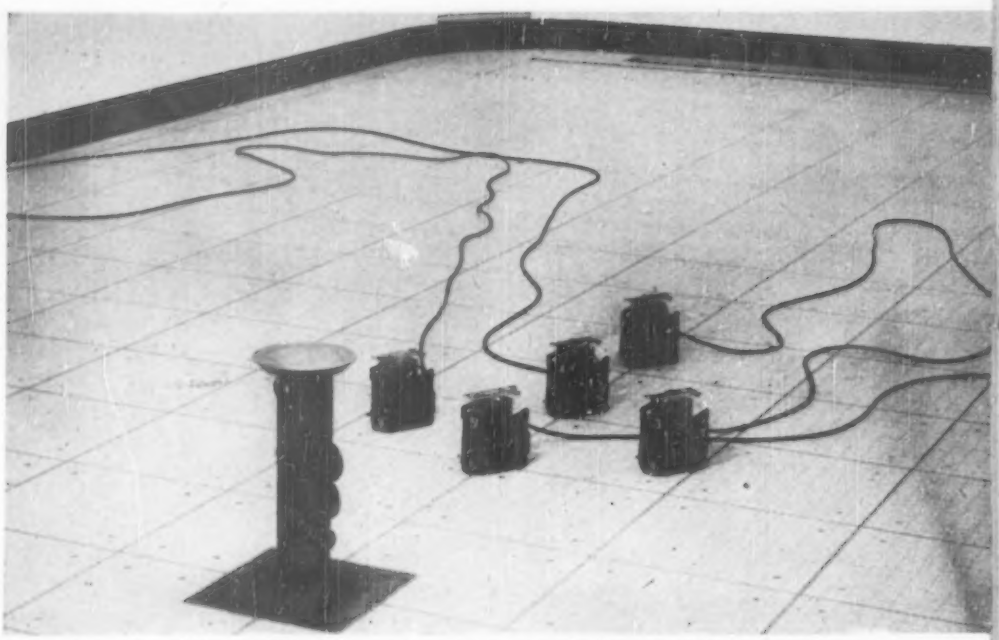
Through periscope, simulated battleship above looks just like real thing. Other targets include all types of warships and cargo vessels. Actually, ships are tiny models, interchangeable upon self-propelled cars like the one below. "Sea" is color photo in periscope. As on real sub, measuring ship's apparent size against periscope markings helps estimate its range.

Stalks-Ships

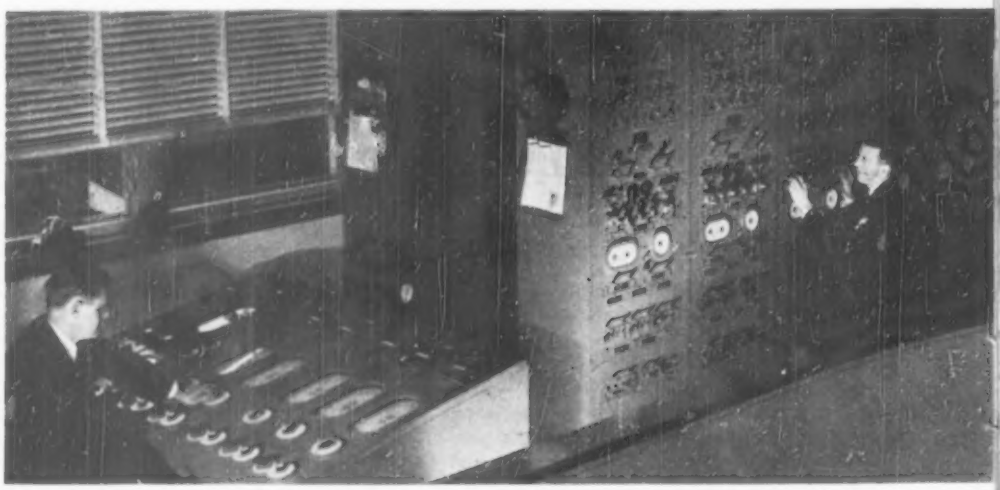
tant, its course and speed computed with lightning accuracy by the submarine's fire-control team. Data go into an electric "brain," a firing key in the conning tower is pressed—and the first of a "spread" or salvo of torpedoes is on its way to intercept the doomed vessel.

All that the drama lacks is the concussion of the exploding torpedoes and the periscope view of the sinking ship. For it's taking place, not on the high seas, but in a dry-land submarine. The conning tower is a stationary steel cylinder within a three-story brick building. The target ship is imaginary, an exquisitely contrived optical illusion. But every instrument and control is real.

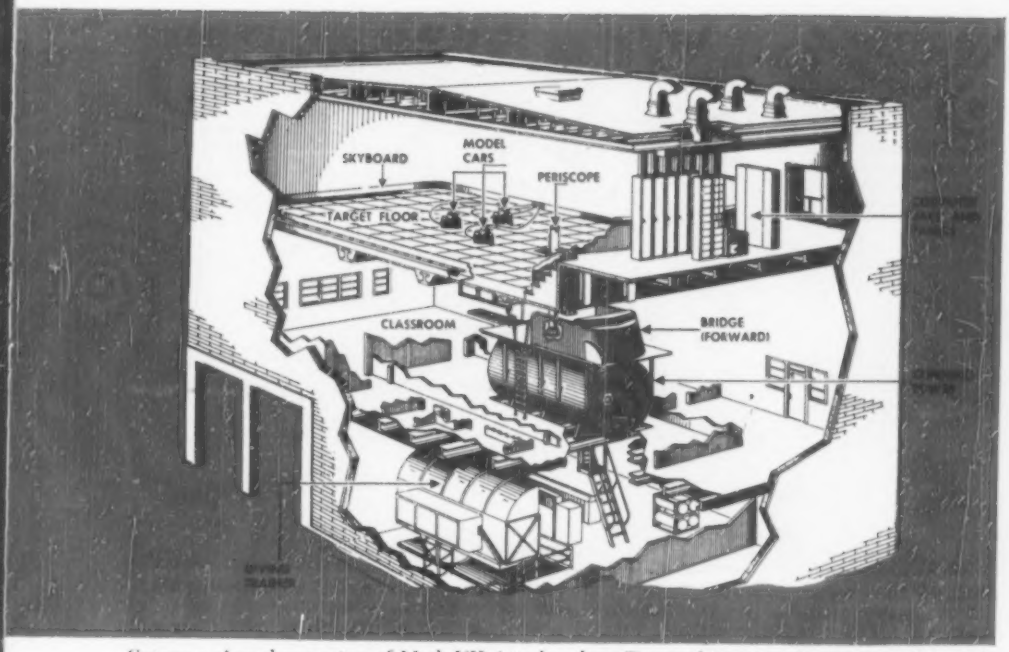




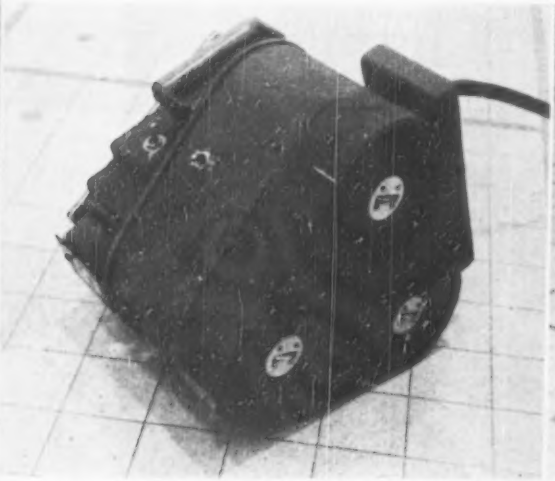
Zigzagging fleet of five model vessels, on individual self-propelled cars, maneuvers upon make-believe ocean. Periscope in foreground has been raised from the conning tower for a peek at them. Nearest ship is within torpedo range, at scale distance of 2,000 yards. Operators take off their shoes and don cloth slippers before walking on floor of terrazzo slabs, which is precision-tooled to a surface that even simulates the curvature of the earth.



Control gallery overlooks ballroom-size floor where models in upper picture are maneuvering. Operator seated at control console is setting target ships' course, a zigzag one based on captured copy of actual Jap "zig plan." Simultaneously, submarine's course is set by students at controls in conning tower. High-speed electronic computer at right of picture automatically "adds up" both courses and gives models correct motion in relation to stationary periscope. Flip of switch makes sub perform like either fast new "guppy" type or older fleet type.

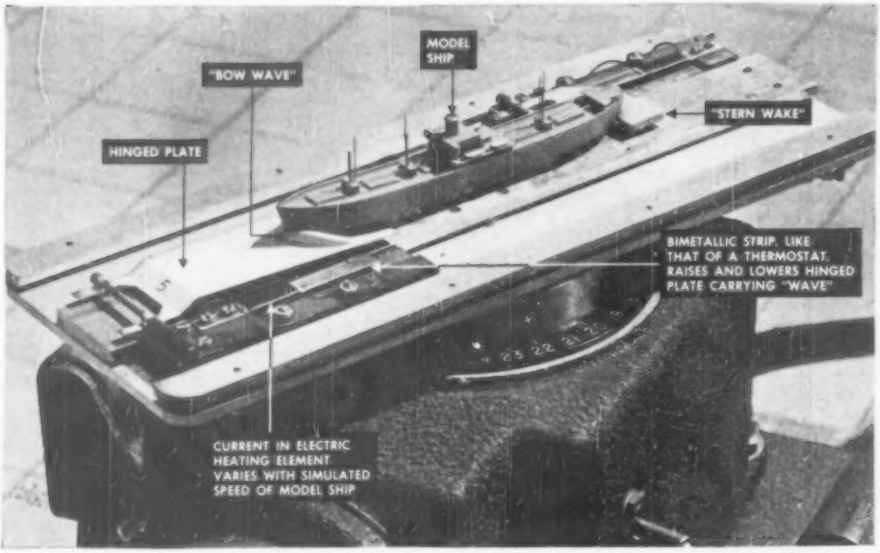


Cutaway view shows setup of Mark VII Attack Teacher in three-story building at New London, Conn., Submarine Base. Model ships sail "ocean" on top floor, and periscope is raised to observe them from conning tower on floor below. Target ships may also be located by radar and, for totally submerged approach, by sound gear. Other parts of "dry-land submarine" are diving and torpedo-room trainers on first floor, which may be coordinated or used alone.



Underside view of triangular, foot-high car that carries ship model shows its three electric-powered wheels, which swivel in any direction. Car can carry model forward, sideways, slantwise, or in a circle. Builder's name for this odd robot is "Precision Recorder Crab."

Moonlight effect for night attack is obtained by lowering blue filter, as above, over clear-glass upper window of periscope. Cap of lowered periscope makes flush fit with floor and models can run directly over it. Students then try for torpedo hit with sub's stern tubes.



Artificial "bow wave" and "stern wake," a recent refinement, give final touch of realism to target-ship model. They automatically vary in height according to ship's simulated speed, helping periscope observers to estimate this factor. Hinged plates on which they're mounted are raised or lowered by varying current passing through heating elements on two bimetallic strips.

and what's happening is exactly what would happen in battle. According to their skill, student submariners will succeed or fail in "sinking" their target.

These students are using the Navy's new "Submarine Attack Teacher," of which three are in service at this writing. The New London, Conn., Submarine Base employs a pioneer 1948 design, called Mark III, and the improved and enlarged version illustrated here, called Mark VII. Another Mark VII has been installed at Mare Island, Calif. All were designed and built by the Special Devices Center, a branch of the Office of Naval Research, at Port Washington, N. Y.

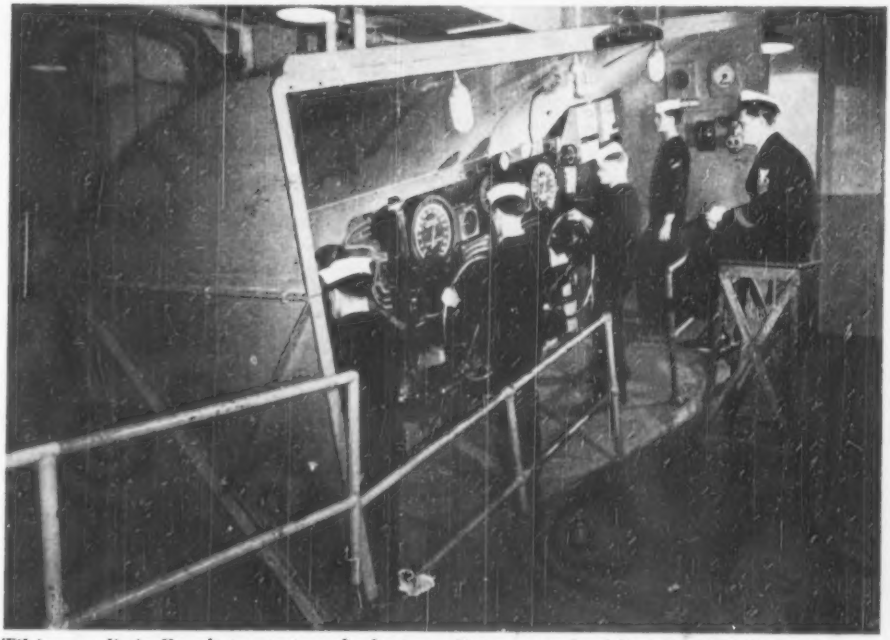
Target ships of the Mark VII trainer are 1-to-1,200 scale models of warships and cargo vessels, mounted on five self-propelled cars powered by trailing electric cables. The "ships" maneuver on a 35- by 58-foot "ocean" in front of a stationary periscope at simulated ranges of up to 16,000 yards or more than nine miles.

Although only the models can move, students in the "submarine" see themselves apparently approaching a zigzagging surface ship. To produce the illusion, the model's motion with respect to the periscope combines the course of the surface ship, set by the training-machine operator, and the course of the submarine, set by the students.

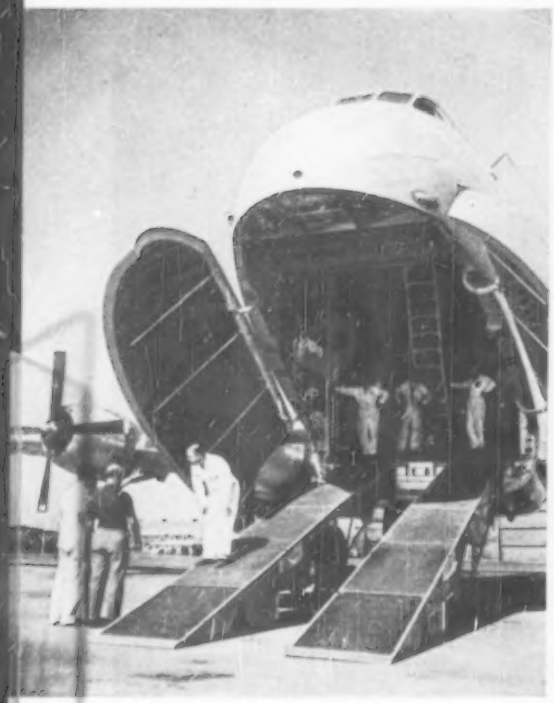
Students can also track targets with the newer aids of radar and sound gear, getting realistic radar "pips" and propeller noises. Synthetically produced by vacuum tubes in accordance with course settings, these are entirely electronic in origin. The visible models and the cars that carry them serve only for periscope observation.

Practice with the machines doesn't replace, but precedes and supplements salt-water training. Every day is a good day for indoor practice, regardless of weather. No time is lost in sailing out to an operating range, getting target ships on station, and returning to base. In two and a half hours, students complete from four to six simulated attacks, each lasting 20 to 25 minutes—a whole day's task at sea. The dry-land instructor can interrupt the students' mimic attack in any phase, "freezing" the situation while he corrects a learner's mistake or discusses an interesting point. The rich variety of practice problems provided by the trainers could be duplicated only in prohibitively elaborate and prolonged naval maneuvers. The $32,000 cost of running an "attack teacher" for a year compares with an estimated cost of $4,500,000 for the same training afloat. END

Diving trainer exactly reproduces center section of a submarine where diving controls are located. Every control gets real action, and every gauge works. Sailors at left and right above are at wheels of stern and bow diving rudders respectively. Large gauge in foreground shows that crew's handling of controls has taken "submarine" down to 80-foot depth.

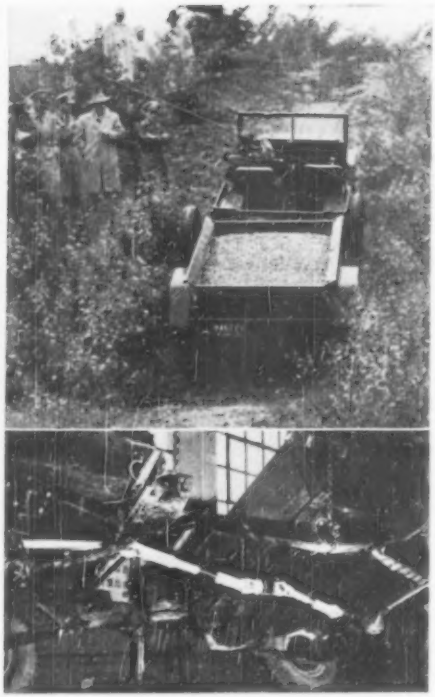


Tilting realistically, diving trainer duplicates fore-and-aft inclination of real craft, as instructor watches group of beginners practice bringing their submerged "submarine" to surface. Using controls of his own, not shown in scene above, he can set motor that rocks trainer to add effect of light swell or moderate to heavy sea on surfaced craft.



Air Force Gets New Giant

THERE's room for two fully loaded city buses in this new Douglas C-124 Globemaster II transport. Built for the Air Force, it is the largest production-model military transport. Its four 3,500-hp. Pratt & Whitney engines enable it to carry a 50,000-pound payload 850 miles, unload, and return without refueling. Giant clamshell doors in the nose and a built-in ramp make it easy to drive big guns, bulldozers, and fully loaded trucks right into the cabin.



Jeep Adds Power Trailer

THE Jeep is still learning new tricks—now it has six-wheel drive to help haul heavy loads over rough ground. The additional two wheels are on a trailer, and are driven by a shaft connected to the Jeep's power take-off (lower photo above). With this help, the Jeep can lug a one-ton load up a 52-percent grade (upper photo). Willys-Overland expects the new development to find farm and industrial use, and perhaps to help tow artillery and ammunition carriers.

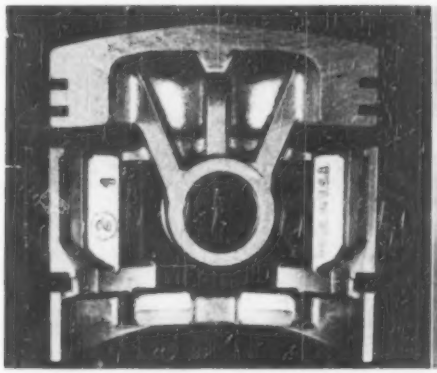
Tiny Cells Run Ear Aids

DRY cells the size of aspirin tablets now make possible small, inconspicuous hearing aids no larger than a pack of cigarettes. The new cells, which form the smallest "B" batteries in production today, are pill-size squares of plastic. Ten of these squares interlock into a stack that forms the one-inch-high, 15-volt battery on the left; two stacks form the 30-volt battery on the right. Developed by Olin Industries, Inc., of New Haven, Conn., the midgets are said to last between 150 and 250 hours.

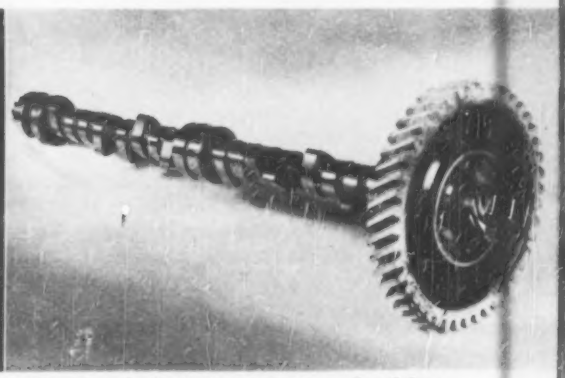
Ford Quiets Engines in '50s

ENGINES in the 1950 line of Ford cars have been made quieter, company engineers say, by a new camshaft timing gear, a camshaft that eliminates tappet noises, and a piston that prevents slap. They also claim increased oil economy for both 6- and 8-cylinder engines from better lubrication. Styling changes are few. But for the first time in its almost half-century of history, the Ford sports a coat-of-arms.

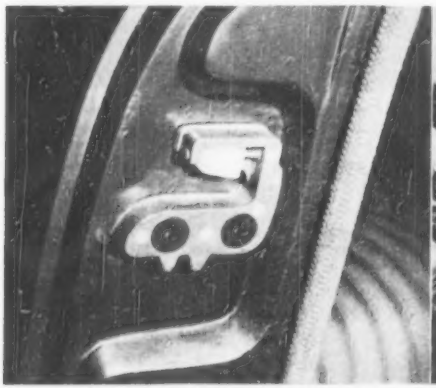
New convertible shows adherence to lines first introduced in Ford's 1949 models. Inside, brake pedal has been moved to right to give more room for driver's foot in sudden braking.



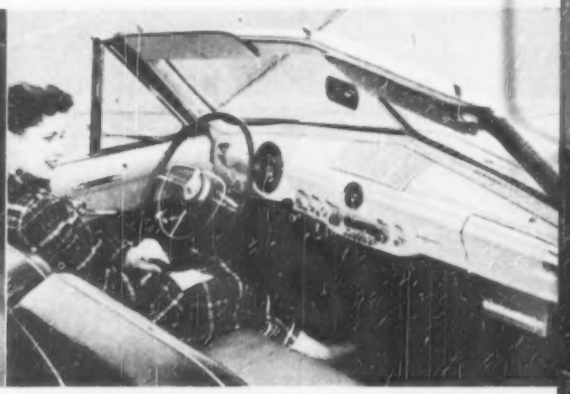
Steel strut cast into new Autothermic® piston controls expansion. This prevents piston from becoming tight when heated or loose when cold, eliminating slap and reducing friction.



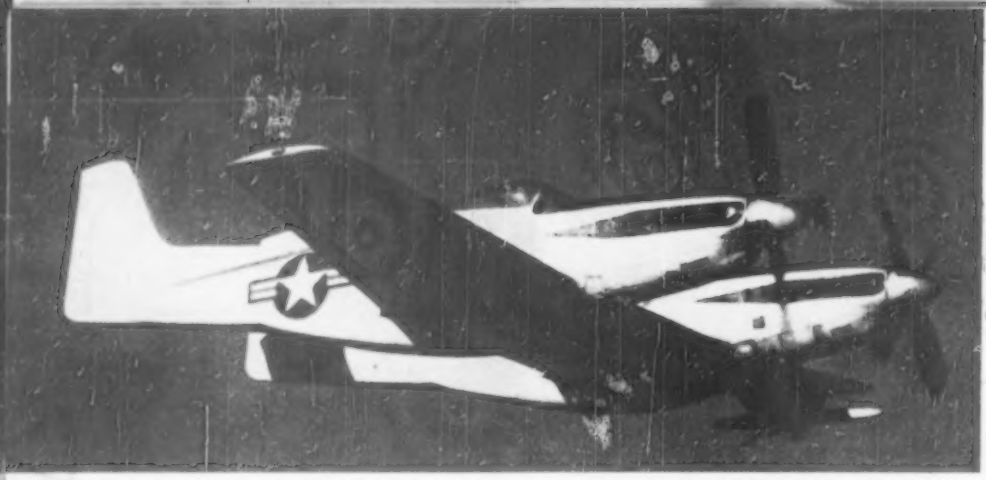
New camshaft timing gear is made of laminated composition material to give quieter operation. Camshaft also has longer opening and closing ramps to eliminate noise from tappets.



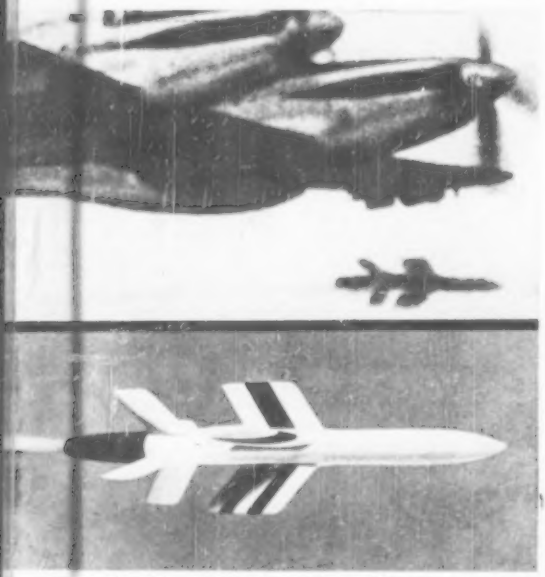
Striker plate on 1950 Ford doors takes some of the customary slam out of closing a car door. A trigger catch on rear deck lid lets you lift lid with one hand until it catches automatically.



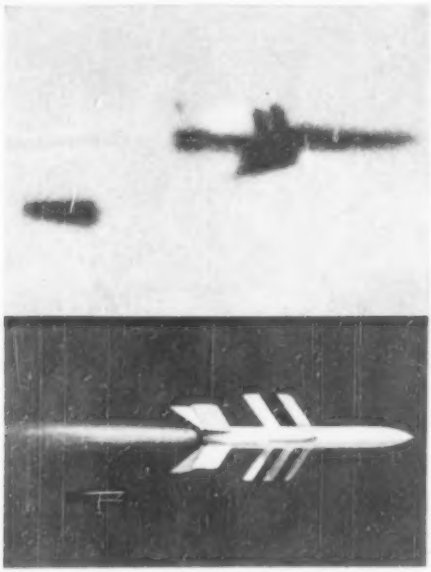
Custom DeLuxe models have instrument panel with dash switch for interior light and colors that eliminate sun glare. Horn-ring corners have been curved so as not to catch driver's sleeve.



The Firebird, under wing at right, is about to be fired from an F-82 twin-Mustang fighter.



Just launched from the mother plane, missile picks up speed with the booster rocket. Top photo is from an actual movie frame; lower view is a posed model showing detail in close-up.



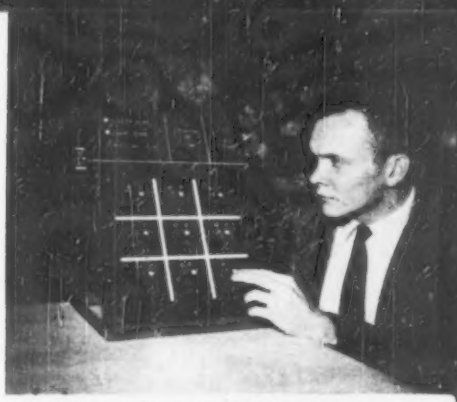
Movie camera catches the Firebird as it speeds toward a "target" on its own flight rockets after the spent booster rocket has been jettisoned. Model in lower photo shows the same action.

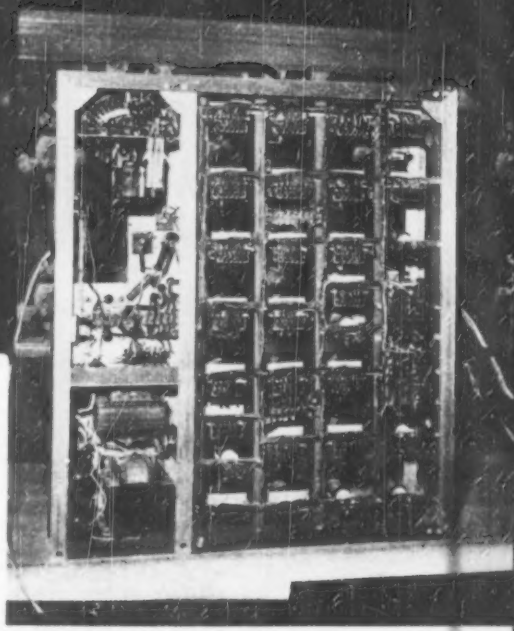
Fighter Fires New Missile

SECRECY wraps have been taken off an air-to-air guided missile described by its maker as the first developed for the U. S. Air Force. Rocket-propelled and designed to carry its own radar brain, the Firebird is an experimental model that will not be put into actual production.

Launched from under the wing of a mother plane, the missile is kicked to top speed by a booster rocket. When this is spent, it is jettisoned by an explosive charge, and the Firebird's flight rockets take over.

Developed by Ryan Aeronautical Co., the missile is little more than 6 inches in diameter and 7½ feet long. Except for plastic radome and wings, it is aluminum alloy.





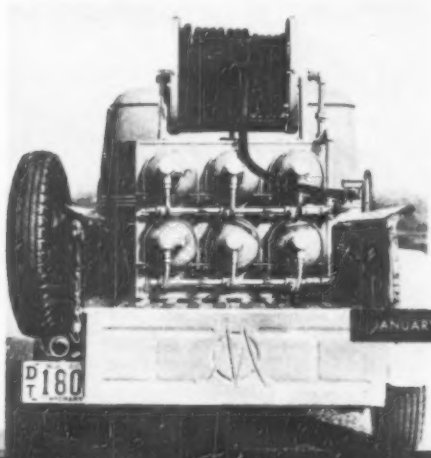
Machine Plays Ticktacktoe

You can't win when you play ticktacktoe against the electric "brain" above—one of the first built just for a game. It never loses—it either wins or forces a draw. But if your pride requires you to win once in a while, you can push a button and make the machine play a little less perfectly. It's no use trying to cheat by filling two squares at once—the machine just ignores the moves.

Robert C. Haufe, 19-year-old technician at the Analysis Laboratory of California Institute of Technology, built the computer largely from salvaged telephone relays (right). It gives first play to the human opponent, who marks a square by switching on a light. The machine then makes up its mind by listing all squares – even "filled" ones – according to their strategic value. It next runs down this list, picks the first empty square, and turns on that light.

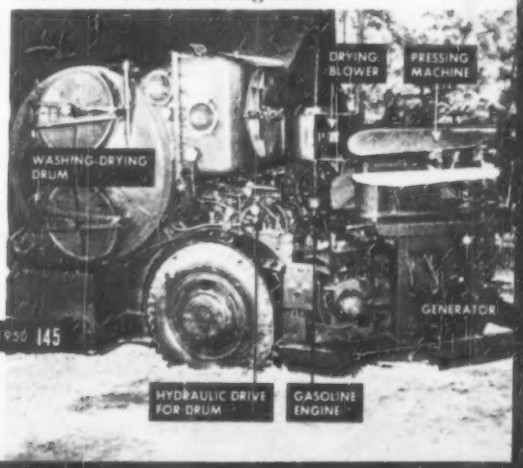
Truck Becomes Fire Engine

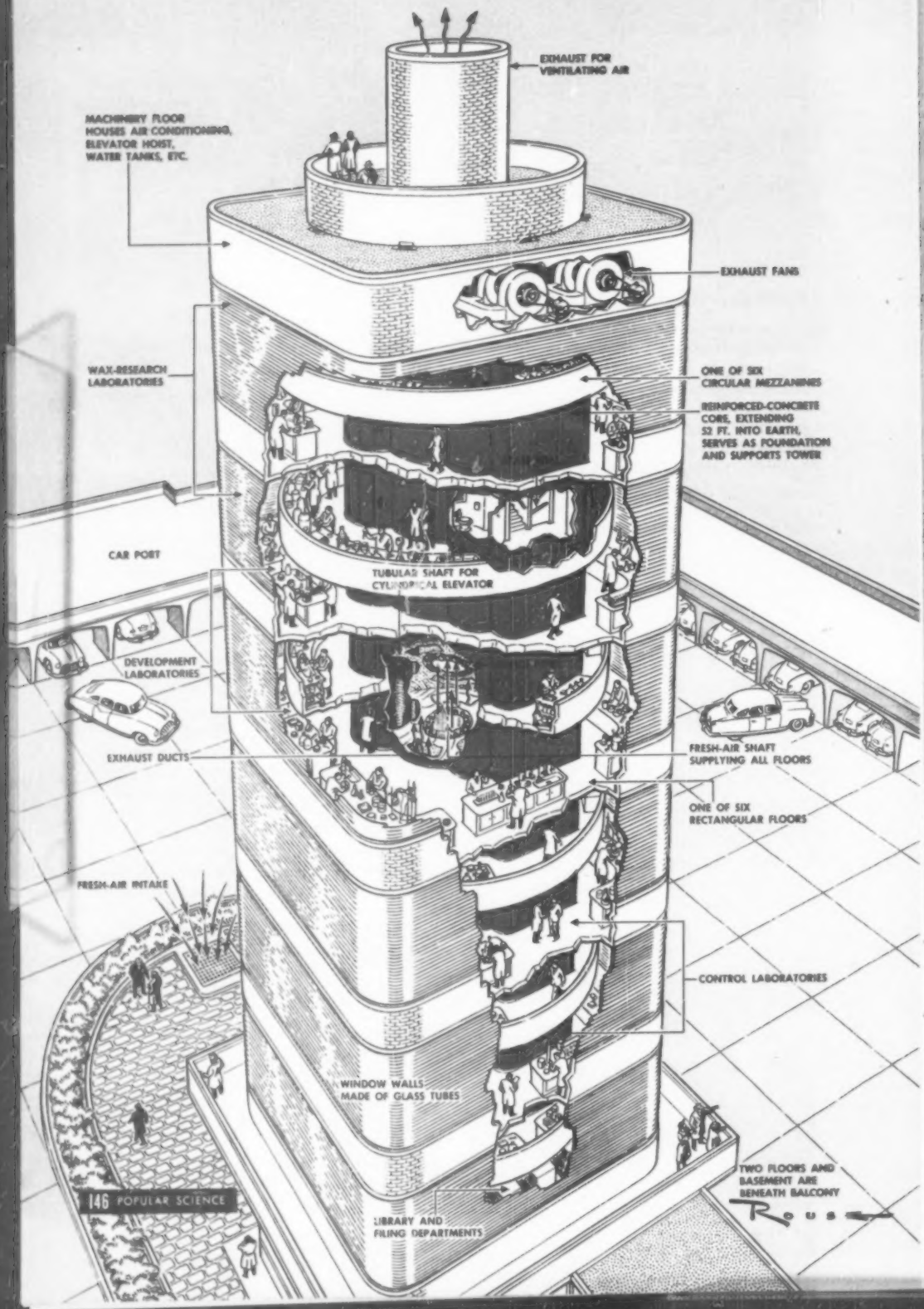
This new Kidde fire-fighting unit quickly converts any one-ton truck into a small, compact fire engine for use in emergency work or as protection at airports, oil fields, dock yards, and industrial plants. Carried in the truck's body, the unit consists of a bank of six 75-pound-capacity carbon dioxide cylinders, arranged to discharge three at a time in two groups. A reel mounted on top of the cylinders holds fire hose that sprays out the carbon dioxide foam at high pressure through a multijet nozzle.



Army Takes Cleaners to GIs

Tomorrow's GI can expect to walk out of a muddy foxhole and get his uniform cleaned and pressed pronto. The Quartermaster Corps has developed a combination laundry and dry-cleaning plant to serve troops in advanced areas. Trailer-mounted, it is ordinarily pulled by a 2½-ton truck but is light enough to be shipped by air. The new unit has an aluminum and stainless-steel drum that washes, rinses, and dries laundry, and cleans and dries woolens. An electrostatic device removes the dirt from the used cleaning fluid.




EXHAUST FOR VENTILATING AIR
MACHINERY FLOOR HOUSES AIR CONDITIONING, ELEVATOR HOIST, WATER TANKS, ETC.
EXHAUST FANS
WAX-RESEARCH LABORATORIES
ONE OF SIX CIRCULAR MEZZANINES
REINFORCED-CONCRETE CORE, EXTENDING 52 FT. INTO EARTH, SERVES AS FOUNDATION AND SUPPORTS TOWER
CAR PORT
TUBULAR SHAFT FOR CYLINDRICAL ELEVATOR
DEVELOPMENT LABORATORIES
EXHAUST DUCTS
FRESH-AIR SHAFT SUPPLYING ALL FLOORS
ONE OF SIX RECTANGULAR FLOORS
FRESH-AIR INTAKE
CONTROL LABORATORIES
WINDOW WALLS MADE OF GLASS TUBES
TWO FLOORS AND BASEMENT ARE BENEATH BALCONY
LIBRARY AND FILING DEPARTMENTS

Research Laboratory Built Like a Tree

Drawings by Stewart Rouse

WHENEVER Frank Lloyd Wright designs a building, you can be sure it'll be different. Usually it is also good looking and functional. This, one of his newest, is no exception.

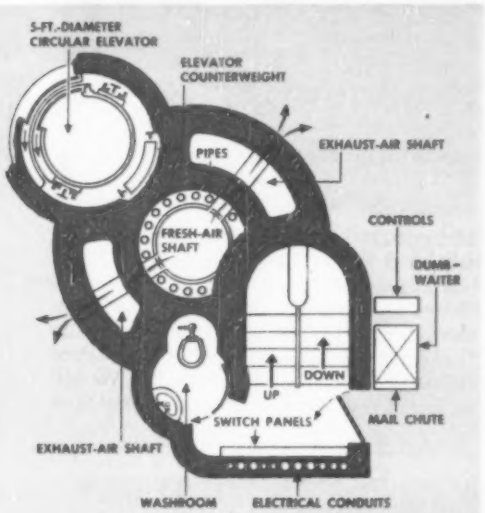
A 15-story research laboratory for S. C. Johnson & Son, the wax-making firm, it looks something like an oversized chimney, but actually is more closely related to a tree. The foundation and load-bearing frame is a reinforced-concrete core, like a tree trunk, that extends 52 feet down into the ground and rises 156 feet into the air. The working floors are supported by cantilevers from the core, like branches from a tree trunk. The outside walls are "curtain" walls—they don't support the building, but merely keep bad weather out. They are mainly two-story-high windows separated by bands of brick. The windows, made of glass tubing, are unbroken by sash.

As in a tree, all supply services are centralized in the core. A large shaft in the center furnishes fresh, conditioned air. Two other shafts on either side take care of exhaust air. Piping for the various laboratory services surround the fresh-air shaft, while lighting and power conduits are enclosed in an outer wall of the core. The core also has a small circular shaft for a cylindrical elevator that can travel all 15 stories in 20 seconds. The elevator even has circular doors and curved counterweights. Opposite this is the stair well.

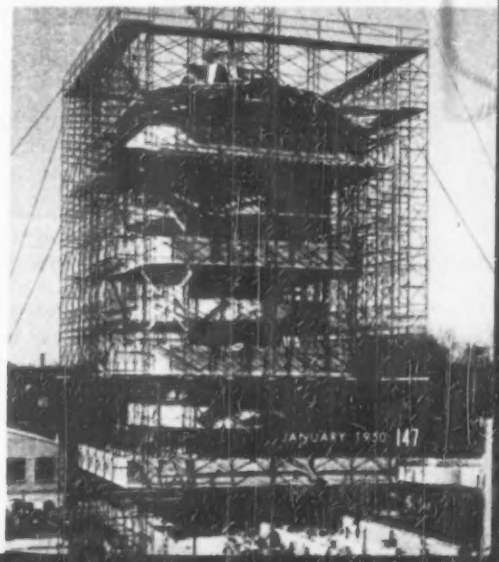
There are two types of working floors: a circular mezzanine balcony overlooks a rectangular, full-width floor. Both types are unobstructed, open to all the light from the huge window walls.

The research tree rises from an open court near the company's administration building, which was also planned by Wright. END

Research tree's trunk, shown in plan view below and in perspective in drawing on facing page (solid-colored section), will contain all pipes, wires, shafts, and other services for building.



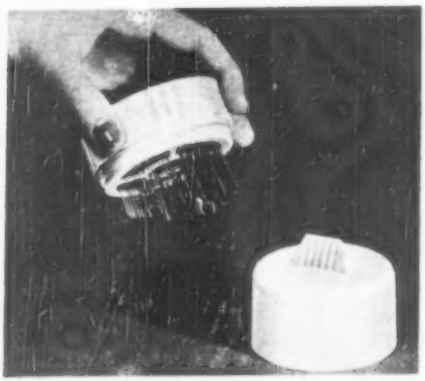
Arrangement of circular mezzanine and rectangular floors that share a two-story-high window can be seen in photo (below) made during construction of S. C. Johnson & Son's laboratory.



Stemware Made of Plastic. Priced from 15 to 25 cents each, these glasses and goblets of polystyrene plastic will add an economical sparkle to your table. The bases and spiraled stems are ruby-colored. The bowls are clear with a faint green-yellow tint to aid the illusion of glass. The maker is the Universal Veilcote Co., Leominster, Mass.

Phone Shelf Has Drawer. This plastic phone shelf that screws to the wall has a drawer for paper and pencil. The maker, Fulton Plastic Products, of Houston, Tex., prices it at about $4. The shelf is a space saver, taking up far less room than a table. It will also keep the phone up out of the reach of a baby's inquisitive hands.

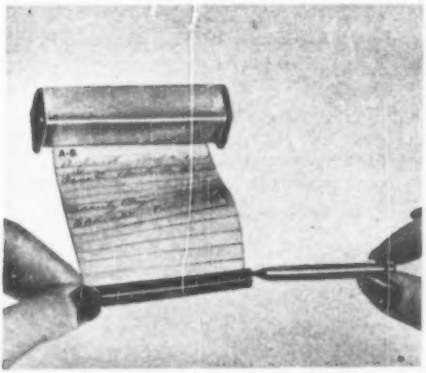
Baby Dish Clips On. Here's a dish that baby can't dump on the floor. Three clamps—one with spring tension—hold it securely in place. It's adjustable for high-chair trays of different sizes. The Hold-Tite® is sold for about $4 by Walter Drake, of Colorado Springs, Colo. The dish is plastic; the holder is rubber, aluminum, and steel.



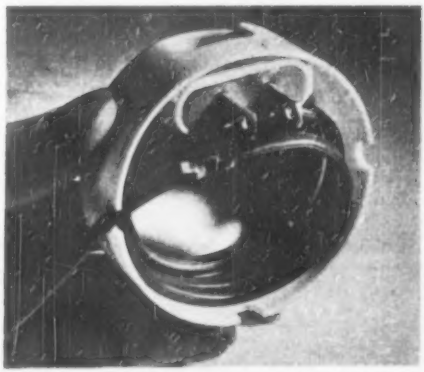
Magnetic Case Grips Pins. Built around a magnet, this plastic case holds hairpins, needles, pins, and even fishhooks. Shown above turned upside down, it holds them upright so you can grab them without fumbling. Howard Industries, Buffalo, offers the cases in four colors for about $1. Wedge on top of the cap spreads open bobby pins.

Ash Tray Fits on Tumbler. If you like gadgets for your home bar, here's a new one—an 11-oz. glass that fits snugly into an aluminum coaster. There's a small ash tray built into the bottom of the coaster. Press a button and out pops the ash tray. They're available from the Mail Order Record Co., of Baltimore, Md., for $18 for a dozen.

Cookie Cutter Rolls to Cut. Instead of stamping out cookies, this aluminum cutter is rolled across the dough like a lawn mower, cutting a whole row of cookies with one stroke. Each revolution cuts out two cookies. The diameter of the cut is 2½ in. The length of the utensil is 6¾ in. The cutters are sold by Paul Douglas & Co., Minneapolis.



Phone List for Your Pocket. The Listik®, made of jeweler's brass, is slightly larger than a lipstick case. A plastic strip, with enough room for 130 numbers, rolls out of the case. Pressing a button winds it back up again. The pull bar holds a handy pencil. The Zephyr American Corporation, of New York City, prices the Listik at about $2.



Excess Cord Stored in Plug. Up to six feet of lamp or appliance cord can be coiled inside this Wyre-Safe® plug. The new plastic plugs can be used anywhere that a standard plug is normally used, in either single or double outlets. They're available in ivory or brown at about $1 each from Page Industries, Los Angeles.

Little Herbert
Beats Dutch Roll

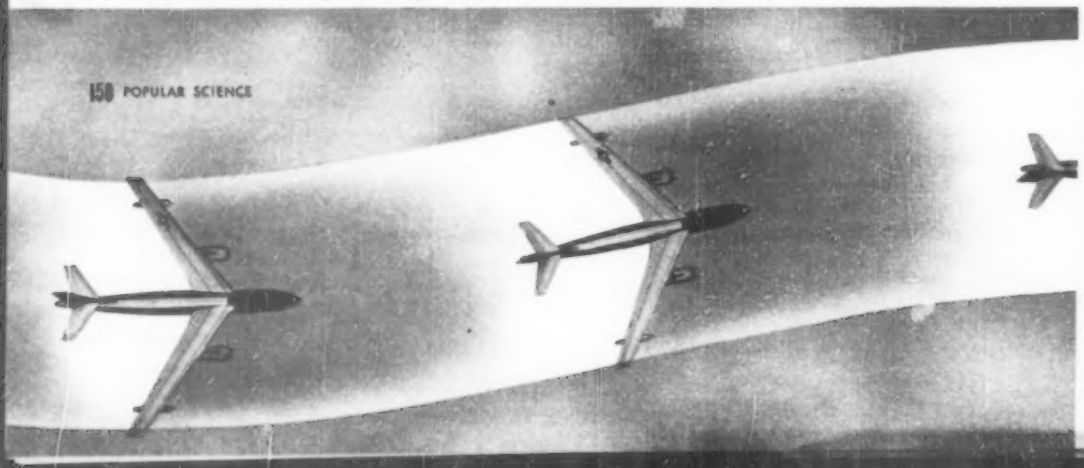
This cartoon shows Little Herbert, the Boeing robot, hard at work. As side gusts push a fast plane's tail either right or left, he automatically applies necessary corrective force to the rudder.

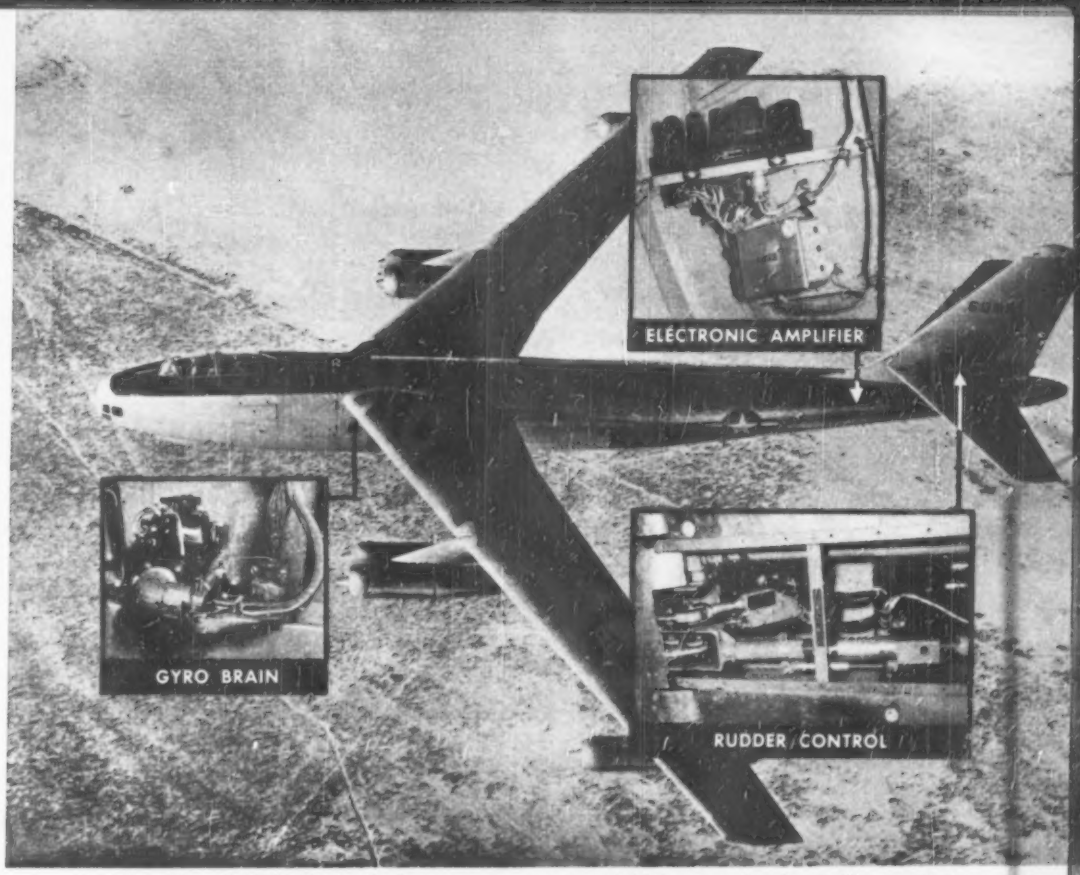
High-speed jet planes have a tendency to roll and sway in flight like a Dutchman ice skating. Here's the cure.

WHEN the "Dutch-roll" gremlins threatened the designs of certain high-performance jet aircraft, especially the swept-wing type, Boeing engineers got to work. Dutch roll is the airman's name for a combined roll and yaw, usually caused by side gusts of wind. The pilot can easily correct this swing and sway by simply shifting his rudder. But since in fast, modern planes the pilot often has his hands full with other jobs, a robot was needed. Enter "Little Herbert."

They built him in three parts. His "brain" is a rate-of-change gyroscope, his "nervous system" an electronic amplifier, and his "mus-

This is Dutch roll, showing one complete cycle of a Dutch-rolling airplane as seen from above.



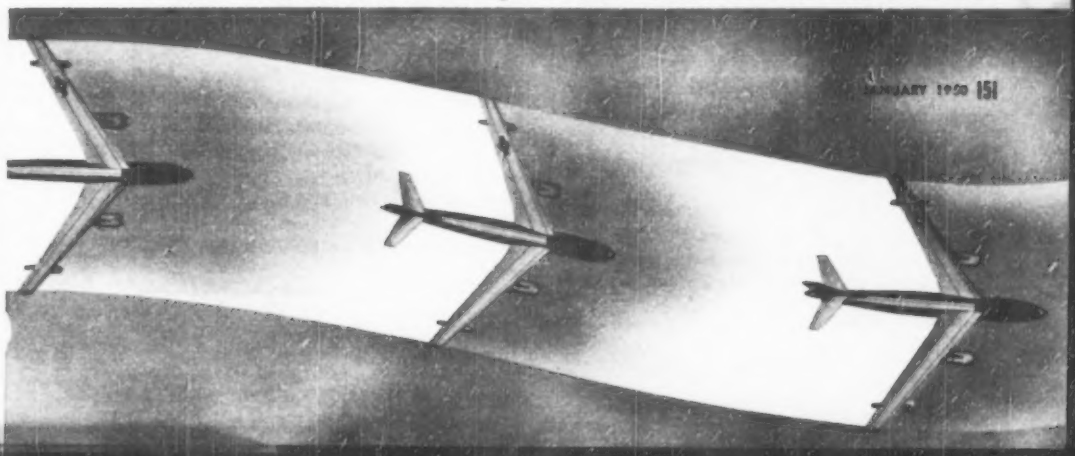


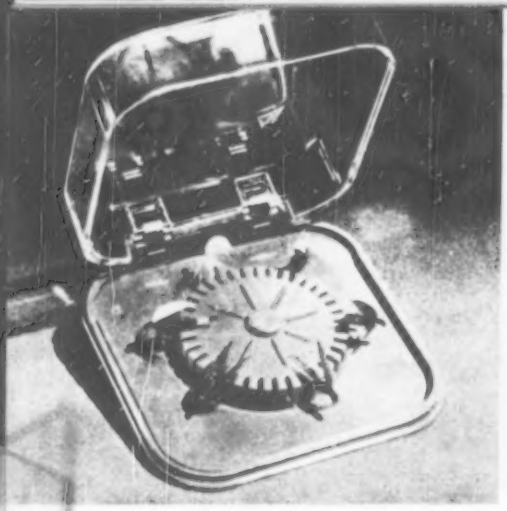
Location of Little Herbert's three components in a B-47 Stratojet bomber is illustrated above.

cles" a small electric motor operating a push rod. The brain, sensing a side gust before it can take effect, sends a message to the amplifier, which immediately relays power to the motor muscles. These lengthen or shorten the push rod, moving the rudder right or left just enough to keep the plane flying straight as an arrow. And in doing his job, Herbie doesn't interfere with either the human or the automatic pilot. These can still shove the rudder around all they wish.

During trials, Little Herbert has cut yaw and roll to less than one-tenth of a degree. With "training," he'll do better. END

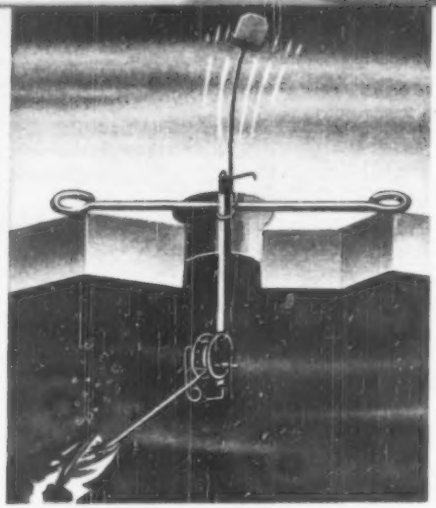
Tilt of the vertical tail shows how the plane rolls, or banks, as it sways from side to side.





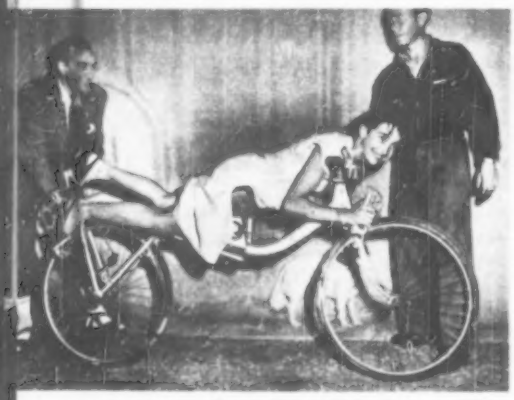
Magnet Holds Fishing Flies

THE meticulous fisherman can now buy a box for his flies that contains a permanent magnet to hold them in place in the strongest breeze. The holder rotates so you can grab the right fly in a hurry. GE, the manufacturer, says the flies can be pulled out easily without damage. The box, about 4 inches square, can hold 36 flies. And it is constructed of clear plastic so that an angler can see the flies without opening the box.



Spring Flips Up Fishing Flag

A FISHERMAN who wanted a new kind of tip-up for ice fishing invented one of his own. His flag is spring-loaded and is released by a trigger when a fish takes the hook. It can be set to go off at the bite of three sizes of fish—large game fish such as muskies and pike, medium-sized fish such as bass, or small pan fish. G. H. Herdegen, of Burlington, Wis., says his Automatic Ice Fishing Tip-Up® will not foul in bad weather.

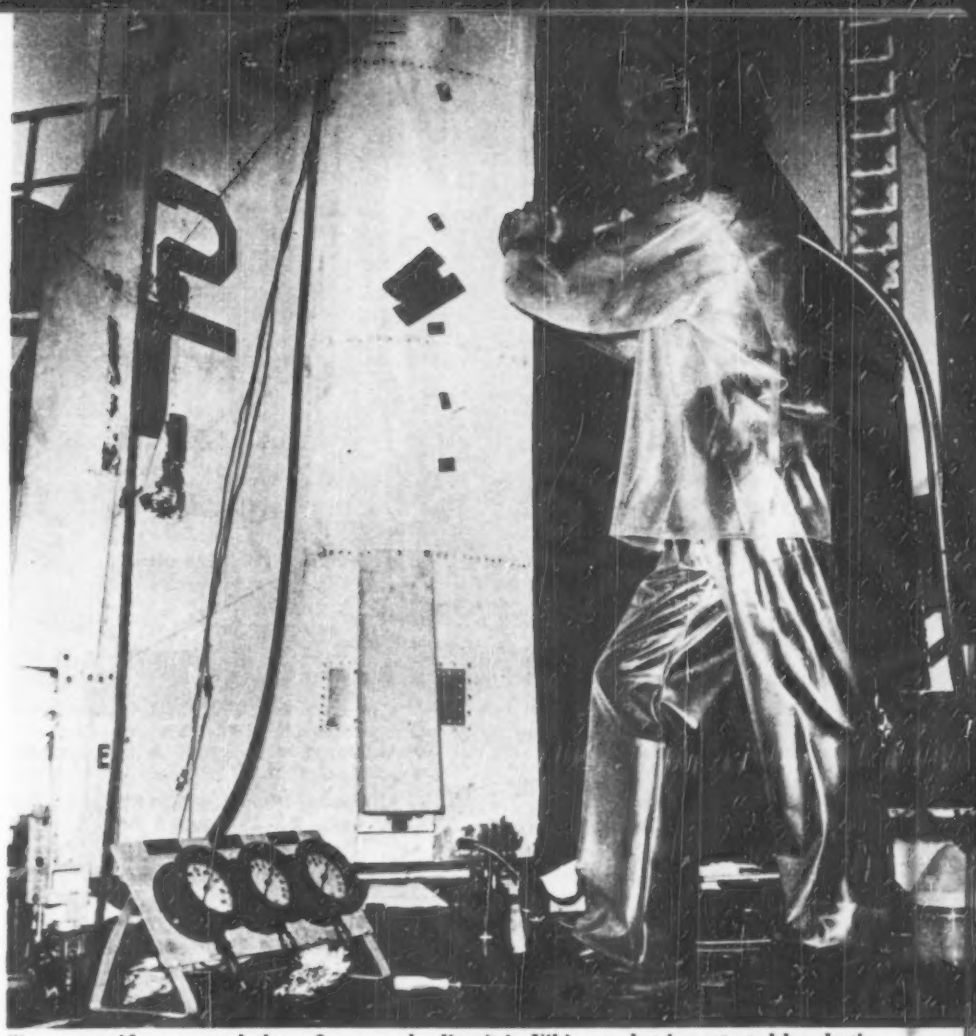


Gone Without the Wind

THE almost-prone position of the cheerful bicycle rider above is the result of a new bike design that is claimed to cut down wind resistance. The bicycle has the usual chain drive, but the pedals and sprocket are above the rear wheel. Hand levers control the brakes. The bike was built for racing by French inventor Pierre Bourguignon.

Popcorn Scooped Faster

IMPRESSED by the unhandy way popcorn bags were filled, Arthur Kloth, San Francisco theater manager, designed this two-ended scoop he calls the Speed-Scoop®. One end, larger of the two, picks up the popcorn; the other end dumps it. Other theaters are buying the invention.



Since peroxide can set clothes afire, man loading it in Viking rocket is protected by plastic.

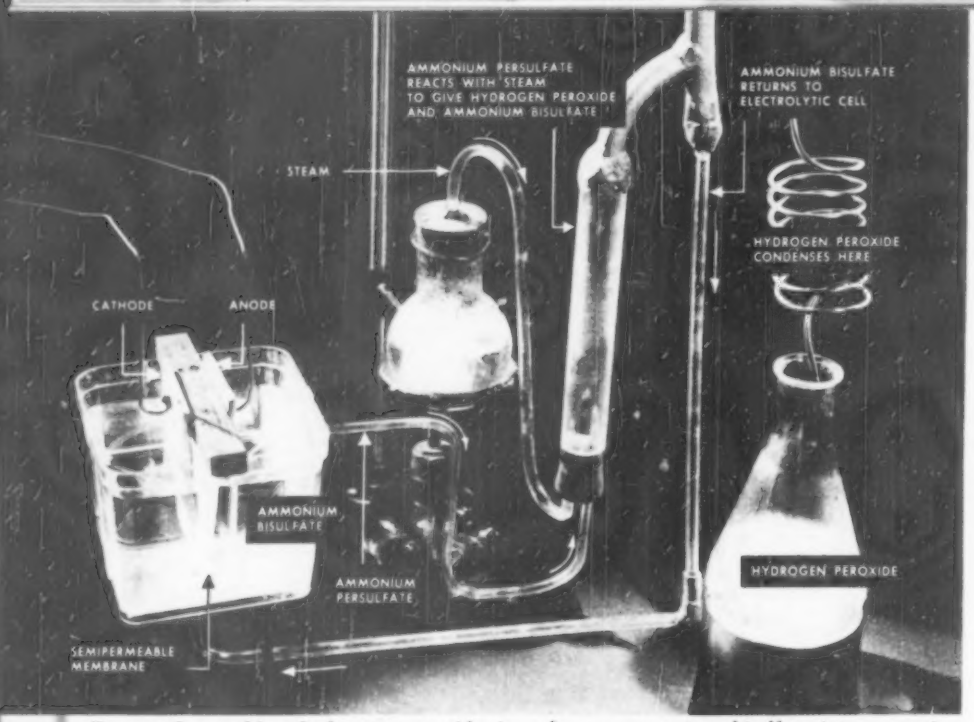
Blondes' Peroxide Now Drives Rockets

Familiar drugstore bleach wins new importance in peacetime industry and as a spectacular military fuel.

By Nat Gorham

PS photos by Kenneth M. Swezey

MENTION hydrogen peroxide and most people think of blondes—the ones who get their light tresses out of a brown bottle. Today this watery chemical has far more important jobs than bleaching hair. It still bleaches—everything from wood pulp to feathers. But it is also a more powerful ex-



Process for making hydrogen peroxide is shown in laboratory setup above. Electrolytic cell changes ammonium bisulfate into ammonium persulfate, which steam changes to peroxide.

plosive than TNT. And it is a strategic fuel: it drives rockets, submarines, and torpedoes.

Hydrogen peroxide was discovered about 150 years ago, but not until just before the last war was a way found to make it concentrated enough for all these new uses. The stuff you get from the drugstore—used mainly as a bleach and antiseptic—is only about three-percent peroxide. The stuff needed to drive submarines is at least 80 percent.

Except for a distinctive odor, concentrated hydrogen peroxide seems much like water. Chemically, it *is* much like water, merely having an extra oxygen atom (the formula is H_2O_2). That extra oxygen atom makes a lot of difference. Leave concentrated hydrogen peroxide alone in a clean container and nothing much happens, except that it decomposes into water and oxygen gas. (Stabilizers like oxyquinoline or phosphoric acid will prevent this.) If your hand is perfectly clean, you can even stick it in the peroxide and do little more than bleach it white. But if there's any dirt—don't. You'll get a bad burn!

Concentrated peroxide reacts violently with almost anything except *clean* stainless steel, pure aluminum, glass, ceramics, and some plastics. It's almost sure to start a fire—or explode—if it touches "dirty" wood, clothing, or other common items.

In short, hydrogen peroxide is what chemists call an unstable compound. It always wants to give that extra oxygen atom to some other material—as the chemists say, oxidize the material. A fire is just very rapid oxidation. And an explosion is just very, very rapid oxidation, usually in an enclosed space. For this reason, peroxide must be handled with extreme care to avoid spilling. The men who load it into rockets wear all-plastic suits and helmets as protection (see the picture on page 153). If some *is* spilled, the antidote is plain water, which dilutes the peroxide so that it can't cause any trouble.

Germans Learned the Hard Way

It took the Germans several explosions before they learned how to make and use it safely. Then they put it to work in some 70 different weapons with fantastic possibilities.

Hydrogen peroxide powered the Messerschmidt 163, only rocket plane that has ever seen fighting service. It could scoot away from the best Allied fighters in the last days of the war, but carried fuel enough for only a few minutes flight. Its 250-lb. engine, which

developed as much power as a 3,700-hp. conventional engine, used a catalyst to make peroxide decompose into steam and oxygen, and then burned an alcohol fuel in this oxygen. The hot gases shot out the back, pushing the plane ahead.

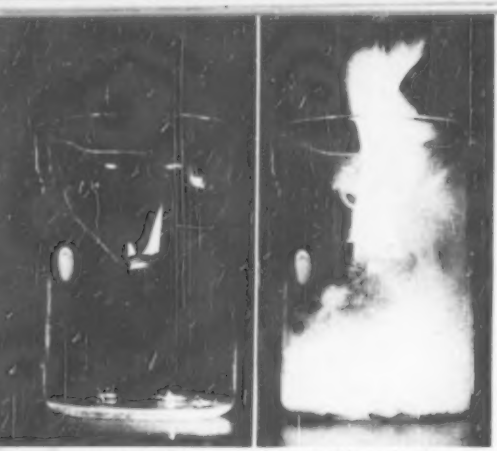
The same idea was used in a submarine that could go *three times faster* underwater than ordinary pigboats. In this case, the steam generated by the reaction drove a turbine and propeller. Five operational boats of this type were actually built. Fortunately for us, none ever got to fight—the Germans didn't have enough hydrogen peroxide.

A similar engine powered torpedoes that, to quote Capt. Logan McKee, U. S. Navy expert, were "much superior . . . to any other torpedo . . . and essentially wakeless."

Both long-range missiles that terrorized London—the V-1 buzz bomb and the V-2 rocket—used peroxide. Simple decomposition of peroxide by a catalyst gave the V-1 its launching push, shooting it up to the 200-m.p.h. starting speed of the ram-jet main engine. In the V-2, peroxide drove pumps for the alcohol and liquid-oxygen fuel.

Our own military researchers are following these leads. The JB-2, American counterpart of the V-1, is launched by decomposing peroxide with calcium permanganate. This gives the buzz bomb a speed of 250 m.p.h. in only 150 feet, the length of the launching track. And the newest of the space-searching rockets, the Viking (PS, Nov. '49, p. 127), has fuel pumps, like the V-2, powered by peroxide. Other applications are still secret.

Baby rocket launcher (below) illustrates war use of peroxide in buzz bomb. When squeezed from dropper onto catalyst—manganese dioxide—it decomposes, shooting "rocket" into air (right).



Gasoline-filled cap burns feebly in beaker containing some peroxide (left). But add catalyst, and oxygen released from peroxide makes flame shoot up (right). Germans did this in subs, planes.

Hydrogen peroxide has two main advantages as a fuel. It decomposes, almost by itself, to release a great deal of heat. And the products of decomposition are themselves useful: the water, as steam, drives a turbine or serves as a "working fluid" in jet engines; the oxygen burns with Diesel oil to make still more heat. The fact that peroxide is a convenient source of oxygen makes it a particularly good fuel for subs and rockets.

The big disadvantage is cost. Capt. McKee estimates it is about 1,000 times as expensive as fuel oil.

In industry, hydrogen peroxide has uses less spectacular but even more important in the long run. It is a universal bleaching agent for all kinds of materials. Wool, cotton, silk, rayon, paper, oils, fats, soaps, leather, buttons, wood (for bleached "modern" furniture), feathers, and many other things are bleached with hydrogen peroxide.

Bleaching is most important peacetime use for hydrogen peroxide. Notice how much lighter cloth becomes after dipping in solution. It is keystone of fast, new method for bleaching cotton.

Within the last year or two, this versatile chemical has opened a whole new field of paper making by successfully bleaching pulp ground mechanically from wood. Paper made from mechanical pulp had been less valuable than that made by other methods because it was gray and dirty looking. Bleached by hydrogen peroxide, however, groundwood paper has found many new applications: in books, magazines, catalogs, directories, tablets, tissue, and toweling. Besides being brighter, pulp paper bleached by peroxide takes printing better than the unbleached, has greater absorbency, equal opacity, and greater cleanness. The "shives" (raw fibers) and dirt specks of unbleached groundwood are softened or eliminated.

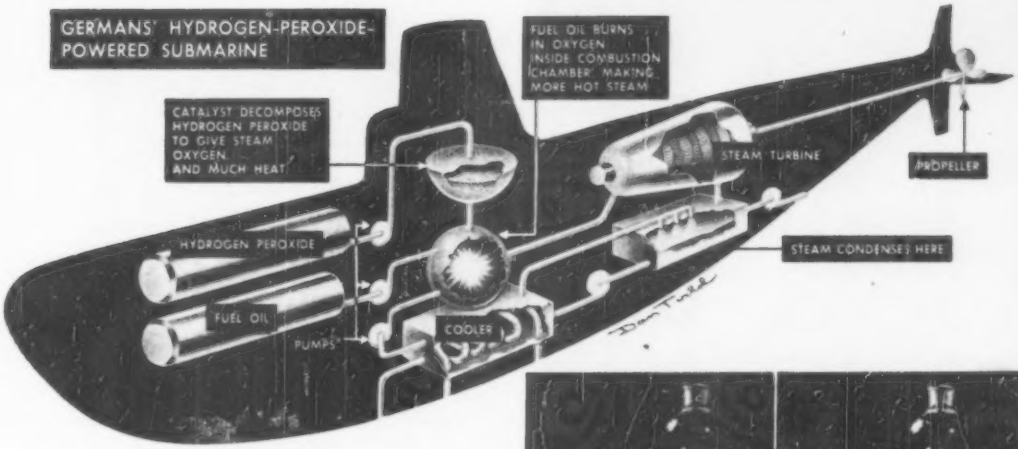
Peroxide Stretches Wood Supply

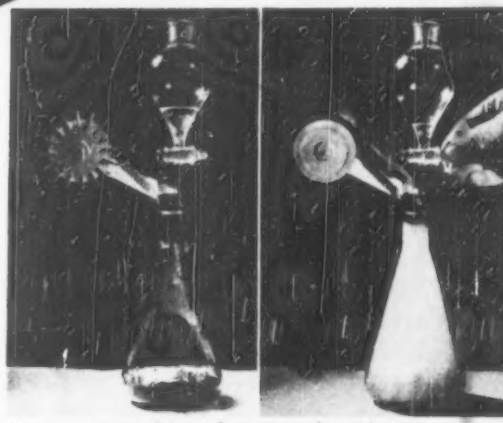
Peroxide manufacturers believe that vast quantities of wood will be saved by using mechanical pulp bleached with hydrogen peroxide. Says Du Pont: "In the production of pulp from wood for paper manufacture, the yields of groundwood are approximately double the fiber yields obtained in the chemical pulping process." Buffalo Electro-Chemical reports: "Such bleaching almost doubles the amount of paper obtained from a cord of wood."

Some of the greatest strides have been made in cotton bleaching. Within the last 10 years, both Du Pont and Buffalo Electro-Chemical, the two largest manufacturers of peroxide, have perfected processes for the production-line bleaching of cotton. By this system, cotton cloth can be bleached in an hour and a half, instead of the 24 hours required by the traditional vat method. Most sheets, pillow cases, shirting, dress goods, and towels are now bleached this way. A new bleachery of the Pepperell Manufacturing Co. at Opelike, Ala., can bleach several hundred thousand sheets a week.

In the manufacture of felt hats, most of the fur is treated with hydrogen peroxide before felting. Peroxide speeds up electroplating and prevents "gray plating." If glue is bleached with reducing-type agents, it generally darkens after drying. Bleached with peroxide, however, glue does not darken.

Hydrogen peroxide is used more and more





Steam spins turbine when peroxide is decomposed by catalyst (right). This principle, combined with fuel oil burning in peroxide's oxygen, powered fast German 17B subs (drawing, top).

in the manufacture of other chemical compounds, medicines, detergents, and cosmetics. Niacin, the anti-pellagra B vitamin, may be produced with hydrogen peroxide. Benzoyl peroxide, used in bleaching flour and grain, as an oxidizing agent, and in plastics making, is synthesized from peroxide.

Concentrated hydrogen peroxide is also being tested as a commercial explosive. The ingredients of the explosive are peroxide and alcohol. Both may be shipped and stored separately without the hazards encountered in handling other explosives. The actual mixing of the two ingredients results in the desired explosion. After the explosion, no poisonous nitrogen gases are left.

The sudden rise of hydrogen peroxide from a drugstore item to an important industrial and military chemical came about because better ways were found of making it. Thirty years ago, it was made by treating barium peroxide with sulfuric acid. Only weak three- to six-percent solutions—drugstore stuff—were obtained, and even they were unstable because of impurities.

First Made in Europe

Shortly after the First World War, 30-percent peroxide began arriving in this country from Europe. Peroxide manufacturers investigated and found it was made by sending an electric current through a solution of ammonium bisulfate. This makes ammonium persulfate, which is then steam-distilled, yielding hydrogen peroxide and more ammonium bisulfate. This ammonium bisulfate is sent right back into the cell for use again in producing more persulfate. The only things used up are electricity and water.

High concentrations are made by distilling the 30-percent peroxide as it comes from the electrolysis process. Water first is boiled off, leaving peroxide and impurities. Then the peroxide is distilled, eliminating impurities.

The big problem in making concentrated peroxide is—cleanliness. That's because it explodes violently if almost any "dirt" gets in. You can shoot at it, drop it, or even set off blasting caps next to it without much danger—so long as it's pure.

For this reason a peroxide factory is an unusual sight. I was privileged to visit a new plant recently. It is not easy to get inside one—the processes involve military secrets, and business secrets, too. What I saw was illuminating. The building of glass brick was spotless inside and out. No wheelbarrows, shovels, or rags were lying around. No dirt anywhere. Much equipment was glass.

Ninety-percent peroxide contains 300 times its own volume of oxygen—one reason it is a good fuel. Drugstore stuff has 10 times its volume, as you can show by adding detergent, catalyst.

I was even more impressed by something else. There wasn't a man in sight in either the big wing where the long lines of cell batteries make the persulfate, or in another wing where the persulfate is distilled into peroxide. The process is entirely automatic. Everything is quiet. Yet gallon after gallon of peroxide pours out of the stills every hour. The only evidence the plant is operating at all is the mass of glass pipes with the clear liquids coursing through them.

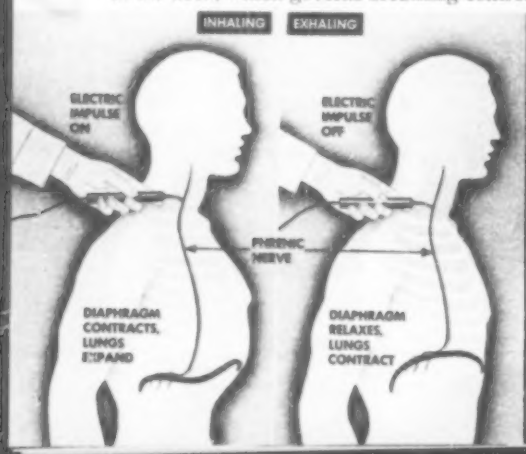
I saw men in the stock room, men in the company's research laboratory, men in the shipping and maintenance departments, and men in the office, but I did not see anyone in the plant itself. It was as close to push-button manufacturing as you can come.

Today Du Pont and Buffalo Electro-Chemical are making more, and better, hydrogen peroxide than Germany ever did. They can supply 90-percent peroxide containing only five-parts-*per-million* impurities. Together these two companies account for three-fourths of all the approximately 50,000,000 pounds made in this country in a year. That's twice as much as was made 10 years ago.

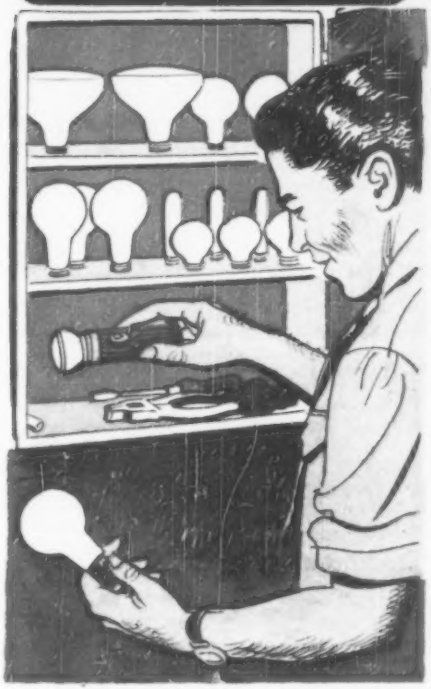
Of this quantity, less than 5,000,000 pounds go to the drugstore. That doesn't mean gentlemen no longer prefer blondes. It's just that hydrogen peroxide can now do even more spectacular tricks than giving a brunette platinum-colored hair. END

Electric Lung Is Latest Polio Aid

A LITTLE box, no bigger than a bedside radio (below, right), is helping to save victims of the dread "bulbar" polio. A feature of this disease is erratic, tortured breathing that regular iron lungs frequently can't help. The new "electric lung," developed at the Harvard School of Public Health, sends impulses to electrodes placed on or near the phrenic nerve in the neck, which governs breathing-control muscles. The timed impulses immediately restore regular breathing, tiding a patient over the crisis. It does not replace the iron lung, developed at the same school, in the commoner form of spinal paralysis, since in such cases the phrenic nerve is paralyzed and unresponsive. However, the compact new device may help in cases of drowning, asphyxiation, or electric shock.

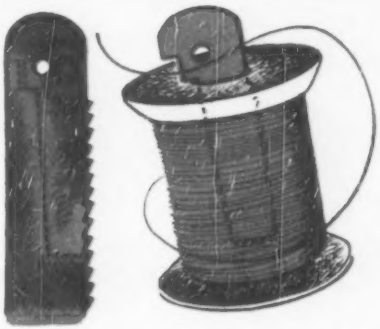


Keeping the Home Shipshape



A bulb-storage cabinet is handy. Drill holes for the socket ends of the bulbs. Allot one shelf for pliers, knife, wire, screwdriver, flashlight, and spare fuses and sockets.

Canvas gloves, turned inside out, make inexpensive dusting mitts. The fleecy lining picks up dust and polishes furniture. Oil them by spraying a little furniture oil on them.



Here's a thread cutter that'll please your wife. Grind one end of a hacksaw blade as shown, putting a cutting edge on the protruding part. Then wedge it in the spool.

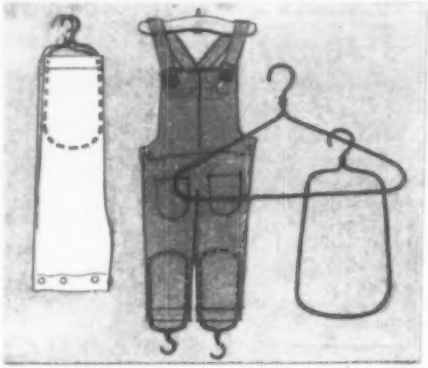
For an excellent paint scraper, place short lengths of old hacksaw blades in a block of hardwood. Cut slots for the blades and space them ¼" apart with the cutting edges down.

To get heavy grease into hinges, dissolve it in dry-cleaning fluid or carbon tetrachloride. After the solution is squirted into hinges, it evaporates and leaves a grease coating.

Turn the page for 5 more suggestions

Keeping the Home Shipshape

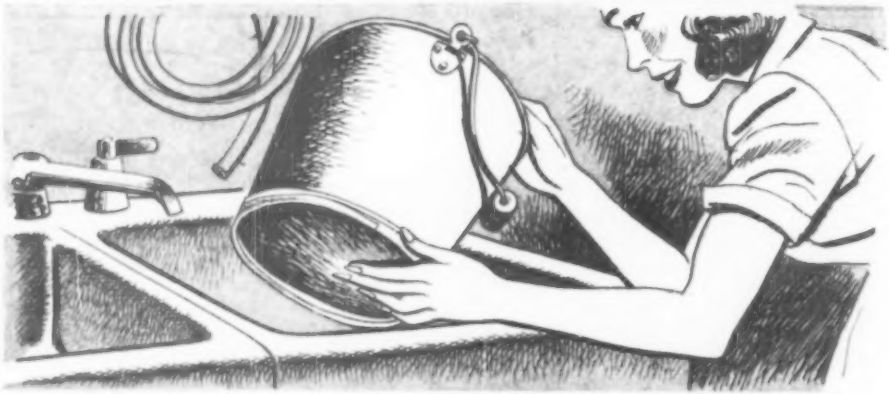
A regular box of soap flakes takes up too much space in a medicine cabinet. Instead, use a small container—like an instant-coffee jar—and punch a hole in the metal top.



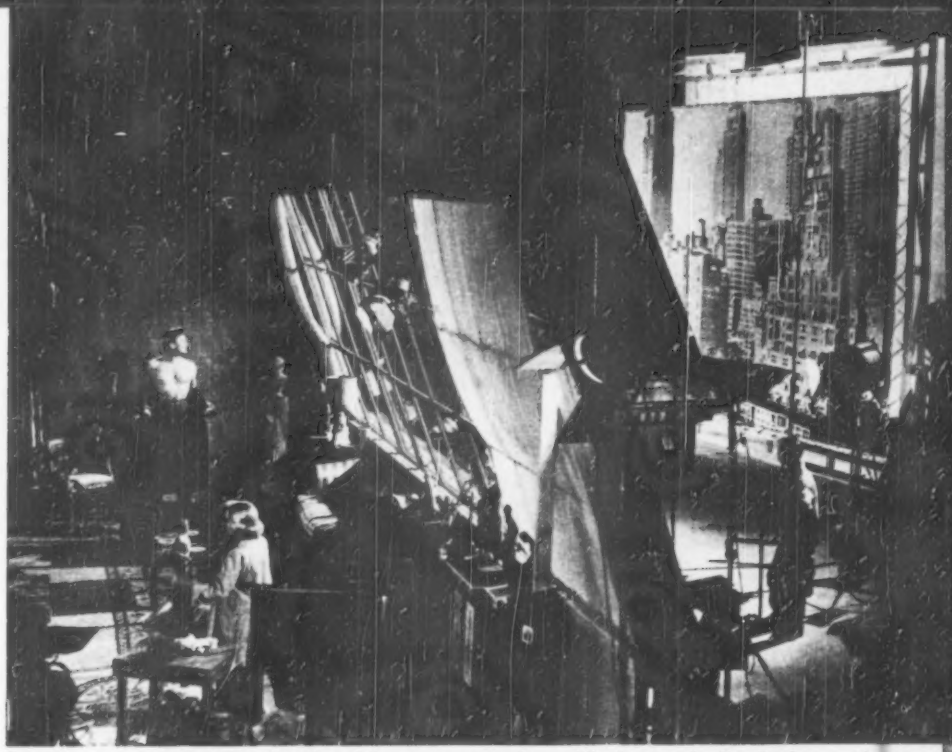
Bend up wire coat hangers to make dryer forms for children's overalls and slacks. Paint the hangers to avoid rust, or discard them as soon as they show signs of rusting.

Use a brush as a darning egg. The bristles hold the hole open better than the smooth surface of an ordinary darning egg. And they let the needle pass easily among them.

When cutting out patterns or turning hems, use bobby pins instead of straight pins to hold the cloth. They are handier, hold firmly, and are easier to pick up if dropped.



To prevent a scrub pail from nicking the porcelain on your sink or laundry tub, wrap three or four layers of waterproof adhesive tape around the bottom edge of the bucket.



Transparency at right, lighted back and front, gives penthouse Manhattan sky-line background.

Giant Transparencies Bring World Indoors

This is how a movie office scene is given realism by a photo backdrop of San Francisco's Bay Bridge as viewed through windows. Transparencies can reproduce any locale in the world.

MOUNTAIN scenery or village greenery—seascapes, landscapes, big-city sky lines—now they come to Hollywood instead of Hollywood going to them. A new combination of huge, blown-up still photographs with color painting produces transparencies that can act as stand-ins for backgrounds in any part of the world. And they are so realistic that you are probably not aware that the scene you see through a window in a movie sequence is not actually towering Pike's Peak or San Francisco's Golden Gate Bridge.

Formerly giant opaque photos were made in sections and then matched and glued on large sheets of fabric. M. B. Paul, veteran motion-picture photographer, wasn't satisfied with this method. So he developed a method whereby a single 8- by 10-inch negative is blown up to a 15- by 20-foot transparency

An 8- by 10-inch contact print is held up to compare it with a 15- by 20-foot translucent plastic enlargement from same negative. Scene from Canadian Rockies is for movie background.

Inventor of the system, movie photographer M. B. Paul, adjusts the lens of enlarger that projects image from a black-and-white negative on a 15- by 20-foot cellulose printing screen.

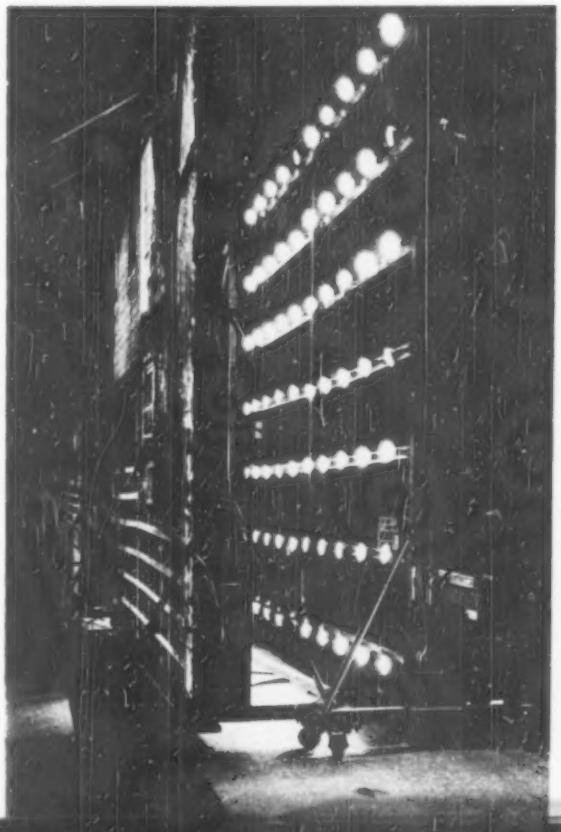
that can be lighted from either side and photographed in black-and-white or color.

Paul starts with a single sheet of cellulose the size of the blow-up he wants. This is pierced around the edges with grommets, laced to a large wooden frame, and stretched taut. Next, working in complete darkness, he sprays a bromide emulsion over the front surface. Then, with a special condenser enlarger, he projects the negative image onto the panel. Dodging paddles (shown in the photographer's left hand in the picture of the enlarger above) are used during the exposure to hold back thin sections of the negative. The image is then developed and fixed in huge, horizontal steel tanks.

Once the photo has been developed and dried, oil colors are sprayed on the back to match the photo on the front. It is this hand decoration that causes the picture to look like a natural-color photo when lighted from the rear. The painting serves several purposes other than permitting photography in color. It supplies a color range, provides a density correction for black-and-white, and creates contrast in areas where contrast is needed.

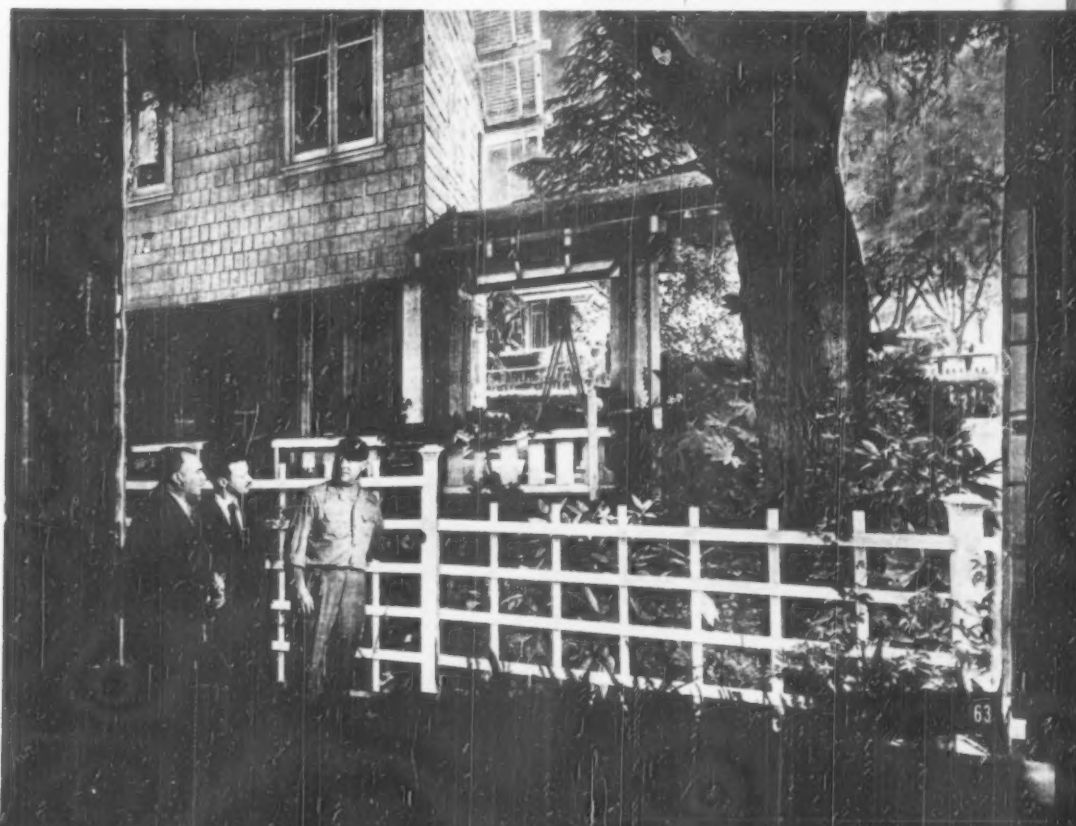
After a transparency has served its stint on the stage, backing up a foreground set, it is rolled up and stored away. Next year it may come out of moth balls for another few weeks before the cameras. This will save movie makers a lot of trips to far-off places. END

Banks of lights, mounted in gooseneck sockets on rack shown below, can be pointed in any direction for special lighting effects. Each lamp can be turned on or off and dimmed individually.



Artists above are retouching and rear-painting translucent enlargements of neighborhood scenes that might be seen from windows of a Pasadena, Calif., home. These particular panels are for a Goldwyn movie, "Beloved Over All," to be released this spring. Use of transparent photo-painted background scenery will save a studio $50,000 in location time on one picture.

Somebody's back yard right in the studio. For realistic night scenes, areas representing windows are cut out to allow brighter light to shine through. Five different screens cover whole neighborhood around house. Power charts are kept as each scene is shot, permitting exact duplication of lighting should re-takes be necessary. Photo below shows front side of transparency.

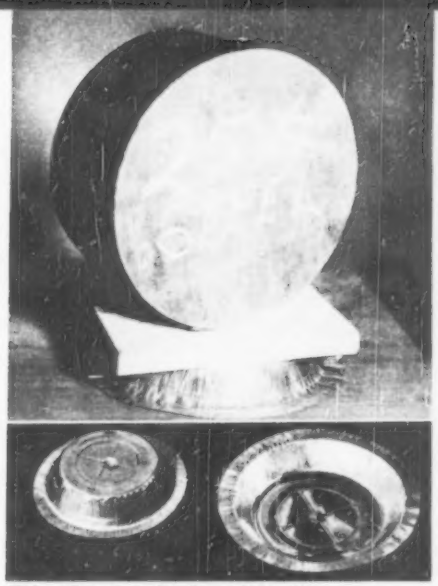


"Ducks" Douse River Fires

THE Army's famous wartime amphibious vehicle has joined the Cincinnati Fire Department. Bought from surplus, two "ducks" have been painted a fire-engine red and equipped with deck nozzles, pumping units, sirens, and two-way radio. The new fireduck has seats for a fire-fighting crew of seven. At left, one of the novel fireboats is seen shooting its waterworks skyward. Photo above shows the fireduck hitting the water after having traveled overland from its firehouse in the heart of the city.

'Copters Don Floats for Fishing and Rescue Jobs

ADVANCE scouting for a tuna-fishing fleet is the job of the float-equipped Hiller 360 helicopter at left below. It is seen landing on its "flight deck" atop the 20- by 20-ft. bait tank on a tuna clipper. At right below is a 10-place Piasecki "Flying Banana" that the Coast Guard has equipped with doughtnut-shaped water gear for sea rescues. The bottom photo shows how the floats, deflated for take-off from land, wrap around the 'copter's wheels. For water landings, carbon dioxide cylinders pump up the floats in 90 seconds.



Pie Plate Made of Foil

THIS throw-away, aluminum-foil pie plate lets a pie be baked and sold in the same container—without that paper-plate flavor. Only .005 inch thick, the pie plate nevertheless can hold a 25-pound steel weight without crumbling, as shown in the top picture above. Its stamped underside, seen at left in lower view, and the lip and side corrugations, at right, prevent the plate from breaking apart at normal baking temperatures. Made by Foil-Kraft, Inc., of Los Angeles, the plates are from 4¾ to 8 inches in diameter.

Revolving Heel Wears Longer

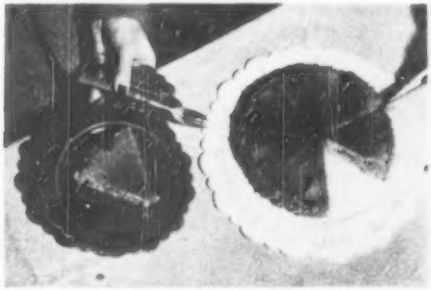
LONGER wear is the object of the new type of rubber heel shown above, says the inventor, Henry Shepherd, of Long Beach, Calif. The size of an ordinary rubber heel, this one has a separate revolvable disk that fits into the back part of the heel and pivots on a hard-rubber peg. This construction allows the heel to rotate as the wearer walks, resulting in more even wear of the heel edge. From left to right in the foreground of the photograph are the disk, the heel base, and the heel with the disk in place.

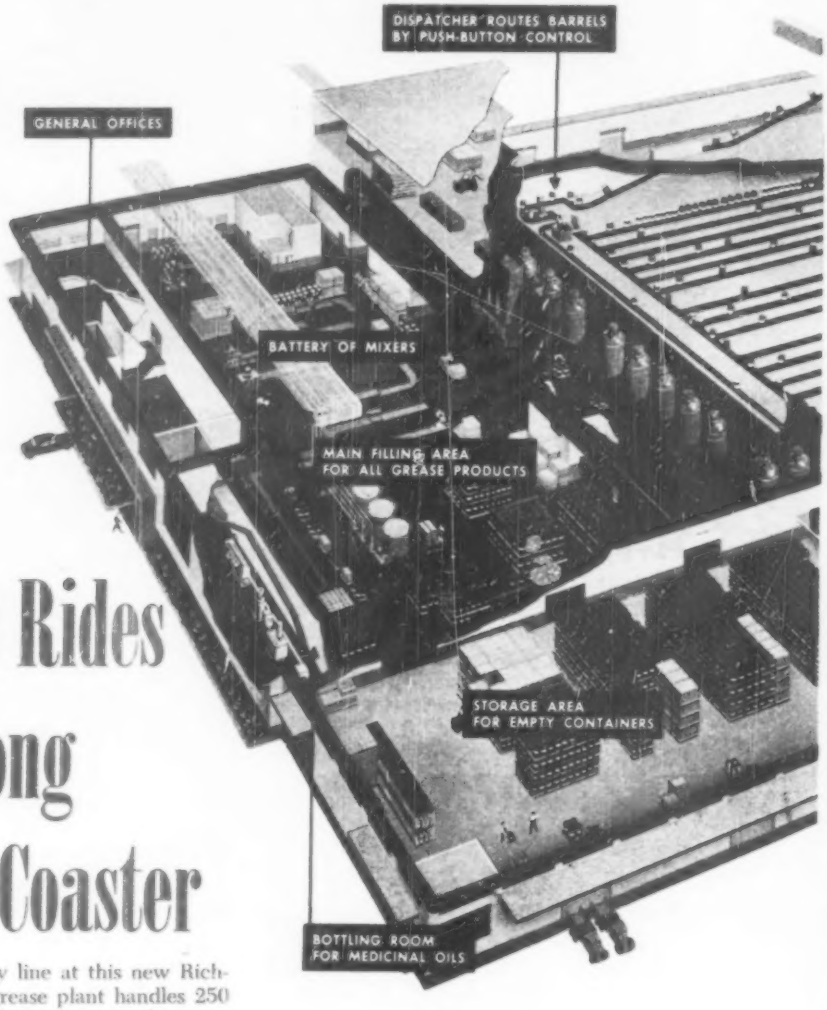
Hangers Help Boots Dry

RESEMBLING inverted umbrella frames, the three-ribbed boot hangers below keep overshoes open and off the ground, allowing air to circulate all around them for drying. Slipped inside a boot, the hanger's ribs spread apart, holding the overshoe suspended by friction. Made by Deschutes Specialties, of Bend, Ore., the hangers cost about $1.95 a pair.

Disk Divides Pie Evenly

THIS circular guide (below, right) helps you divide a pie or cake evenly. The hostess just cuts from the center to the numeral, repeated at intervals along the disk's edge, that matches the number of persons to be served. The buffet plate (left) has an extension to hold a fork for lap serving. Frederic Mantout, a Frenchman, invented both.

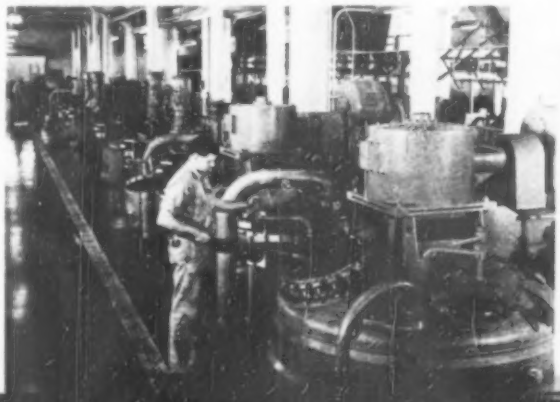


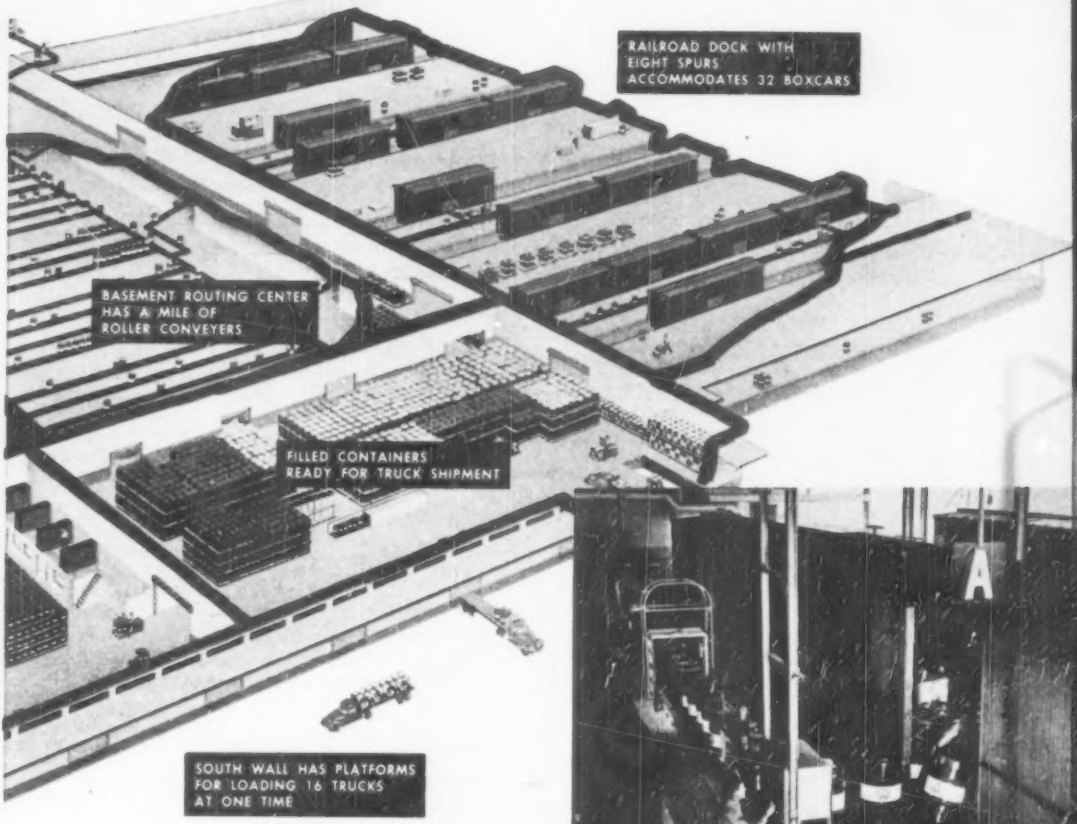


Grease Rides Mile-Long Roller Coaster

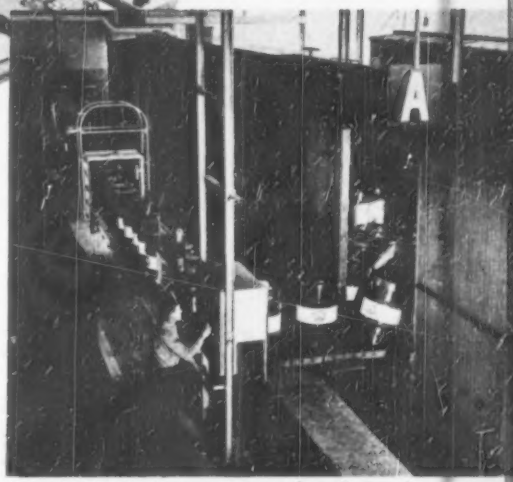
A ROBOT delivery line at this new Richmond, Calif., grease plant handles 250 varieties of packaged petroleum products at a rate of one container every three seconds. As drums and barrels speed along to trucks and freight cars, they are weighed, stenciled, counted, and routed by electronic controls. Powered rollers keep the line moving. The rollers used on inclines are partly filled with liquid potassium chloride, which retards their rolling speed and acts as a brake to prevent smash-ups. The flow of barrels or boxes is directed by one operator. From his central push-button control panel, he switches pre-counted loads to their proper shipping terminals. Much of the conveyer equipment was designed specially for this plant. Owned by Standard Oil of California, it's said to be the world's largest grease-packing plant.

Giant versions of a kitchen mixer stir up to 75 barrels of grease in one batch. Each mixer is automatically temperature-controlled. Twenty-nine of them mix 38,000,000 pounds a year.



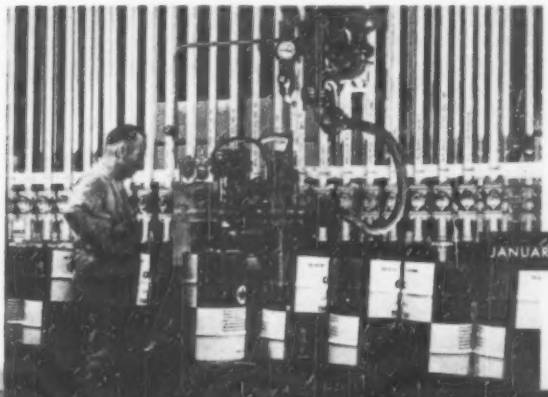


Push-button grease plant shown in the cutaway above is seven-and-a-half acres of electronic and mechanical efficiency. Twenty miles of pipe lines in the building feed oils and compounds for mixing with dry ingredients to make petroleum products ranging from pharmaceutical white oils to the heaviest lubricants. The conveyer system handles 1,200 cartons or barrels an hour.

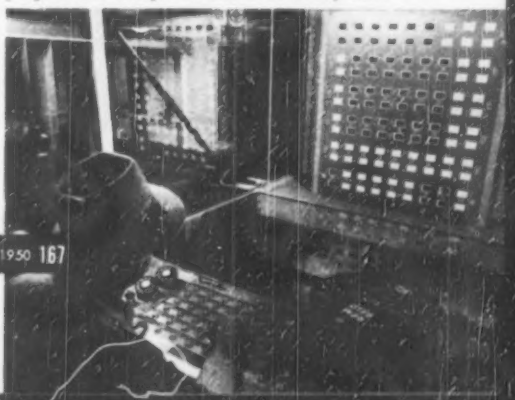


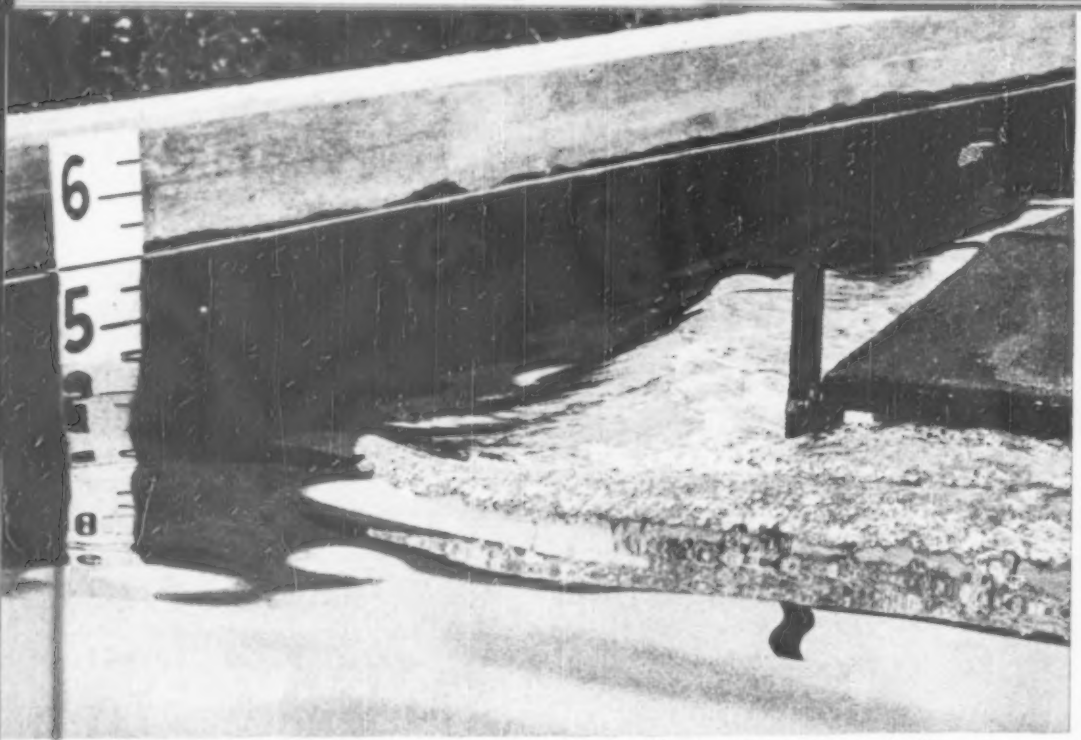
At end of mile-long conveyer, barrels are diverted into waiting boxcars by the operator shown at control panel above. Only manual handling is by workers inside freight cars.

Here 100-pound drums are being filled with petroleum products for the export trade. Flow from automatic mixers on floor above shuts off when weight limit for each container is reached.



At central control panel, below, push-button operator keeps electronic count of barrels to be loaded into each boxcar, and routes them to proper railroad spur at end of delivery line.





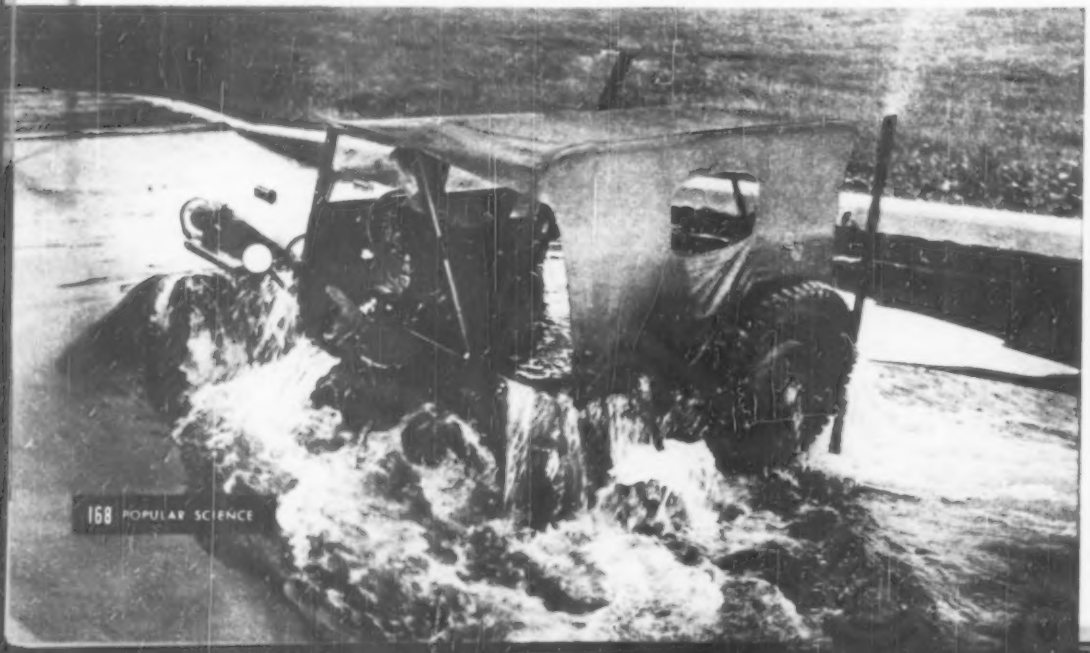
Army Ordnance's waterproof jeep chugs through test tank at Aberdeen Proving Ground, Md.

Jeep Starts Under Water

PS photos by W. W. Morris

DUNK this jeep like a doughnut and it comes up for more. Waterproof electrical and carburetion systems keep it from conking

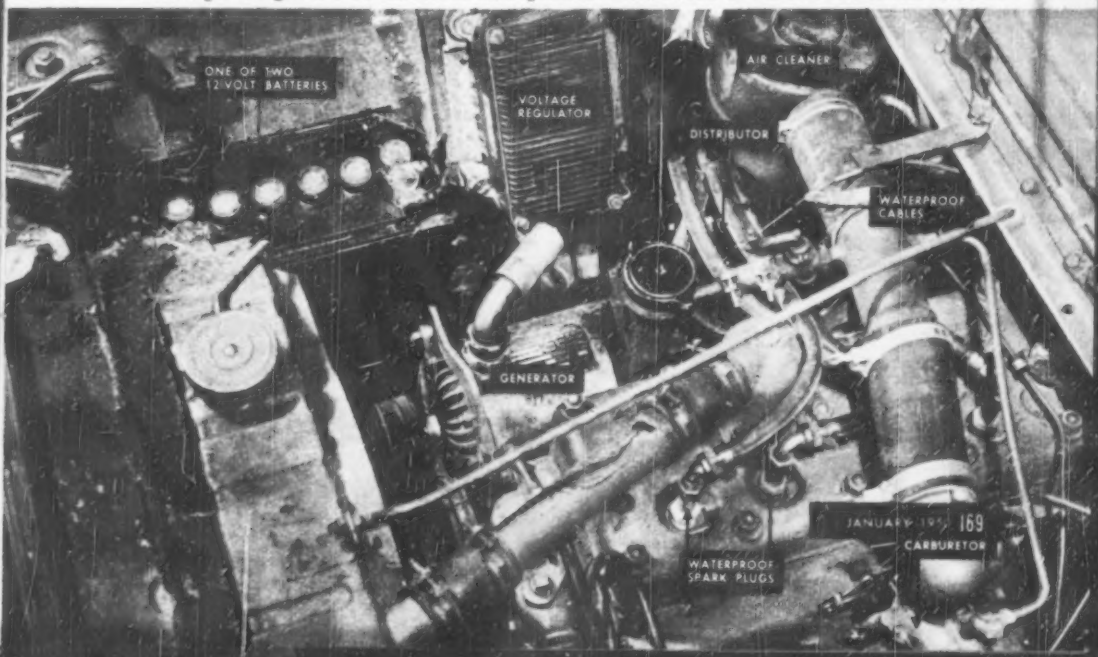
Water pours out as jeep leaves tank. Breather-pipe and tail-pipe extensions act as snorkels.



Marker shows depth of nearly five feet. Driver must almost stand to keep head above water.

out. You can even stop and start the engine under water. Wartime combat vehicles were laboriously waterproofed with asbestos grease that had to be stripped off as soon as they hit dry ground. The new waterproofing is built-in. The engine is pressurized by sealing the front end of the crankshaft and closing the vent valves on the crankcase. As the engine runs, its pistons build up six pounds of pressure, keeping out all water. END

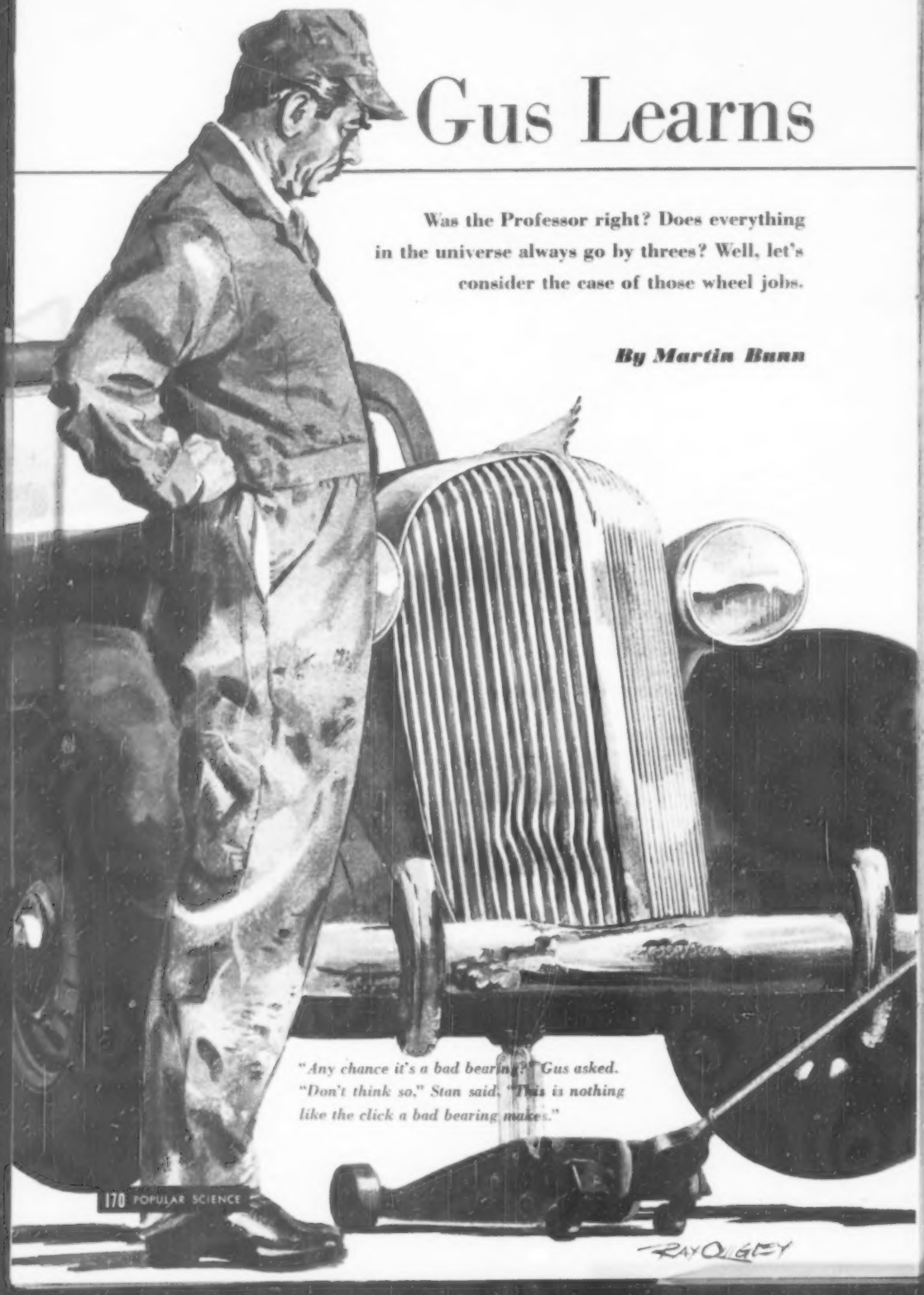
Close-up of engine shows details of waterproofed carburetion and 24-volt electrical systems.



Gus Learns

Was the Professor right? Does everything in the universe always go by threes? Well, let's consider the case of those wheel jobs.

By Martin Bunn



"Any chance it's a bad bearing?" Gus asked. "Don't think so," Stan said. "This is nothing like the click a bad bearing makes."

the Rule of Three

PULLING into the Model Garage after an errand downtown, Gus Wilson grinned with recognition when he saw a battered '35 sedan on the shop floor. "Gabriella, the car that thinks for herself," he mused. He well remembered the day a year ago when the car, through a temporary and still unexplained refusal to start, had kept him from jerking loose the air hose that Greg Jones had draped around the rear bumper.

As Gus got out, the curious figure of Dr. Jason Evants stepped from behind the hard-used vehicle.

Gus shook hands heartily with the town's most eccentric citizen. "Glad to see you again, Professor. How's the Philosophy of Universal Sentiency coming along?"

Dr. Evants gestured with a skinny hand. "I have progressed beyond that," he said gravely. "Presently I am engaged in a study of the Phenomenon of the Sequence of Three in human affairs."

Stan Hicks, who had just come up, looked startled. "Gee, Professor," he asked in an awestruck tone, "what's that?"

Dr. Evants' keen eyes glittered. "It is an all-important natural phenomenon which you undoubtedly have experienced, young man, but have failed to evaluate. Haven't you ever read an unfamiliar word or heard an unfamiliar name, and then had that new word or name brought forcibly to your attention twice more within a very brief period of time? Everything in the universe goes by threes. Everything!"

Stan's eyes goggled. "Gee, Professor! That's right! Why, the other night I met a babe named—"

Dr. Evants' decisive gesture cut him short. "Obviously, young man," he said, "you have experienced one of the less complex of the manifold manifestations of the Sequence of Three. Ponder on it, and learn to turn it to your advantage."

"I'll do that, Professor—I certainly will!" Stan said earnestly. "This babe—"

"That carburetor job is promised for ten o'clock, Stan," Gus reminded him diplomatically. "Now, about Gabriella, Professor—has she been warning you again by refusing to start?"

Dr. Evants shook his shaggy head. "No. But she may be attempting to warn me against driving slowly—"

"You mean against driving fast, don't you?" Gus interrupted.

"I invariably mean precisely what I say!" Evants snapped tartly. "I repeat that Gabriella *may* be trying to warn me against driving slowly by emitting an as yet unidentified rattling sound which ceases when she attains a speed of exactly 18 miles per hour. On

the other hand, the rattle may be merely the result of some obscure mechanical maladjustment or imbalance. I am confident your expert investigation will determine which is the fact."

"Okay, Professor," Gus said, smothering a grin. "I'll be glad to look the old gal over, but I can't do it right now."

"At your convenience, Mr. Wilson. I shall return at five," Dr. Evants replied.

"Boss," Stan remarked early that afternoon, "I promised Wiggins I'd deliver that battery to his shop soon as it was charged. Maybe I better do it now."

"Maybe so," Gus agreed. "Wait a minute, though. No need of getting the wrecker out. I want to test the Professor's bus. I'll take you and the battery up to Wiggins' place."

They got into Gabriella, and Gus drove out of the shop. The rattle started as soon as the wheels began to turn and continued while they worked slowly through the sticky traffic. When they got out on the highway and Gus speeded up, the noise suddenly stopped.

Stan was watching the speedometer. "Just like the old guy said," he commented. "It quit when she hit 18. Why, boss?"

"That's for you to find out," Gus said.

"That'll be easy," Stan predicted cocksurely. "Something to do with th' wheels."

When they got back to the Model Garage Stan pried off Gabriella's hub caps one after another. As he removed the fourth one, a wheel nut clattered to the floor.

Was It a Careless Mechanic?

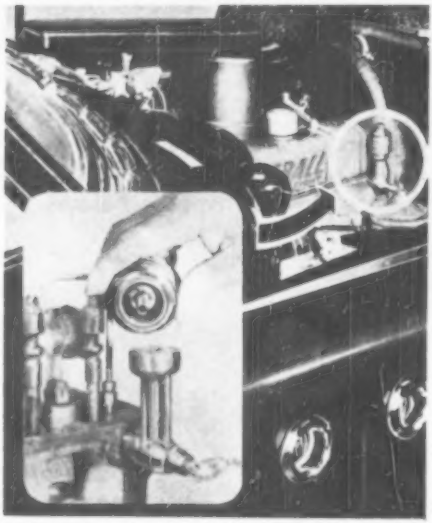
"Somebody besides the Professor must have been absent-minded," Stan mused. "Sure didn't tighten that nut—or it wouldn't have worked loose and rattled around inside the hub cap." After tightening it securely on the stud, he reported his success.

"Good for you," Gus applauded. "But what made the rattle disappear?"

Stan looked blank. "I forgot about that," he confessed. "I'll take another look."

"You needn't," Gus said. "Ever hear of centrifugal force? That's the answer. When

New Filter Cleans Valve Oil



INSTALLED in the oil line coming from the crankcase, this filter is said to help prevent distribution of damaging sludge or scale to overhead-valve parts. Termed a rocker-arm oil-line filter, it's made by Ralph F. Roussey and Associates, Inc., of Chicago, and sells for about $7.50. The filter is easily removed for cleaning.

Leverage Breaks Beads Loose

AFTER a tire has been mounted for a long time, it's often difficult to break the bead loose from a rusty rim. The homemade device shown here, which would be especially valuable in a repair shop, does the job easily. It can be quickly made from steel strap, say about 3/16" by 1½". The foot need not be as fancy as that shown in the photo. A spade-like end on the pivoted arm breaks the bead when you press the handle down. A coat of paint will keep the device from rusting.—*C. A. Cole, Graham, Ala.*

the car got up to 18, the w. .els were turning fast enough so centrifugal force held the nut at the edge of the cap."

Stan thought it over. "I get it," he said at last. Then, after more thought: "Say, boss—do you think we'll get two more wheel jobs today, like the old guy said?"

"Well," said Gus, "the Professor's smart, but that Phenomenon of the Sequence of Three sounds like so much hooey to me. But whatever comes in, you'll have to take care of it. I'm going to pull this transmission."

He still was busy some time later when Jim Jelliff drove his business coupe into the shop—but not too busy to cock an ear and hear Jim tell Stan there was a mysterious rattle that seemed to come from one of the wheels. Stan sidled over to Gus, a delighted look on his face. "Another wheel job!" he whispered.

Sold on Dr. Evants' theory of the Sequence of Three, and confidently expecting to find another loose wheel nut, Stan removed each hub cap and checked every nut individually. But all were tight. A half hour of trouble-shooting got him nowhere. Finally, he walked over to Gus. "I'm stumped, boss," he said.

Leaving his transmission job, Gus took a look at all the wheels. Then he drove the car around the block. He was grinning when he returned. "You've found the trouble," he told Stan. "Take the bus for a ride, kid."

The Second Case Is Solved

From the corner of his eye Gus watched Stan replace the hub caps and drive out. Ten minutes later the young mechanic was back, looking dejected. "The rattle's as bad as ever," he said.

"Use your head," Gus told him. "I tested the car without the hub caps. You put them on before you took it out."

"Why, sure!" Stan said, brightening. "One of the hub caps must be loose."

Quickly prying off all except one of the caps, he again road-tested the car. No rattle. The same with two caps. But as soon as he started out the door after installing the third cap, the rattle popped up again. Looking closely, Stan could see the retaining clips weren't doing their job. He bent them so they would hold tighter—and the rattle was gone.

As he finished his transmission job, Gus glanced at the shop clock. Half-past four. He grinned at Stan. "Looks as if the Professor's Sequence of Three is going to bog down."

"Still have an hour to quitting time," Stan said stubbornly.

A horn sounded outside. When Stan opened the shop door old Silas Barnstable, the town's leading penny pincher, drove in and hopped out of his veteran sedan. "Hey!" he yelped. "There's a funny noise!"

"There always are funny noises in *your* car," Gus kidded him. "What's this one?"

"It's a mean noise," Silas told him. "Thump. Bump. Not loud—a dull, sneaky sort of noise. Irregular like. Only hear it when I'm drivin' slow—under 20. Funny part of it is I don't never hear it except when I'm on a dead-smooth road. If I cut the motor and coast, I can hear it real well. Sounds like it's somewhere in the wheels."

Stan jumped. Gus laughed. "Stan's specializing in wheels today," he chuckled.

Still going on Dr. Evants' theory of the Sequency of Three, Stan pried the hub caps off Barnstable's car and drove it up the street. But, to his disappointment, the noise was still there—a faint, elusive thump that seemed to come from one of the front wheels. He drove back to the shop.

"Well," said Gus, "so long as you've got wheels on your mind, why not jack up those front ones and see if you can find anything?"

Stan followed instructions. After considerable wheel spinning, he came up with the information that the noise was coming from the left front wheel.

"Any chance it's a bad bearing?" Gus asked.

"Don't think so," Stan said. "This noise is a dull thump—nothing like the click a bad bearing makes."

Just then a customer tooted at the gas pump and Stan hurried out. Gus stood looking at the wheel for a moment, thinking. Then he grabbed a lug wrench and quickly

pulled off the wheel. Keeping pace with it, he rolled the wheel the length of the shop, like a boy rolling a hoop, leaning over to listen closely as he did so. When Stan returned, Gus was standing at his workbench writing out a time slip.

"What'll I do next, boss?" Stan asked.

Gus didn't look up. "Take off the tire and bring me the tube," he said.

Stan shrugged his shoulders, but was back with the tube in a couple of minutes. Gus shook the tube—an amply patched one—and grinned when he heard a slight noise in it. "There's a stone in it," he said. "That's what's making the noise."

How Did It Get Inside?

Deflating the tube completely, Stan could easily feel the stone. "But how could a stone—"

"Hey, Silas," Gus interrupted. "How long since you had a blowout?"

"Last week," Silas said. "Out in the country on a gravel road, it was."

"Who patched the tube?" Gus demanded.

"Feller in th' Four Corners garage," Silas told him. "Do a job cheaper than you fellers in town."

Gus let him feel the stone in the tube. "That's the cause of your noise," he said. "The stone must have been driven in through the hole in your tire casing, and the fellow who patched your tire sealed it in. . . . Better have a new tube. This one isn't worth another patch."

"Well, I dunno," Silas said. "Tubes are right high these days. Guess you'd better fix this one. Th' two patches have held all right, so why shouldn't another one? I've noticed things go by threes."

Dr. Evants had come quietly into the shop. "Sir," he said to Silas, "you have discovered through experience one of the deepest of nature's secrets. Should you desire to pursue your investigation of it on the philosophical level, I am at your service. My forthcoming book—"

"Your car's ready, Professor," Gus interrupted. "That noise came from a slight mechanical misadjustment. Gabriella wasn't trying to warn you."

When Dr. Evants and Silas had finally driven on their separate ways, Stan turned to his employer. "Now, boss," he asked seriously, "do you believe in the old guy's dope about threes?"

Gus laughed. "You bet I do!" he said. "Matter of fact there's one part of it I've always believed in. So far today, I've had two meals. And now, if you'll close up the shop, I'm going straight down to the Park House—and have the third one. I *always* eat by threes!" END

Deaf Motorists Can Drive Well

You might think deaf persons would not be safe drivers, but Dr. A. R. Lauer (left above), head of the Iowa State College driver-training program, declares otherwise. Leonard Lau (at wheel) is an example. Here he goes through some final practice in hand signals. In sign language, the instructor says "stop." The driver gives the approved signal.

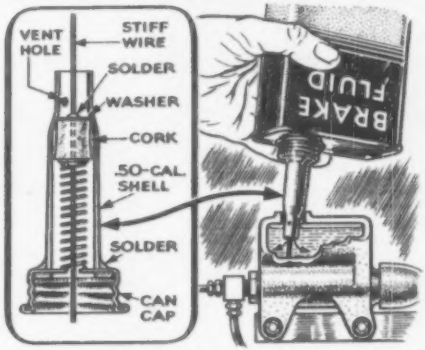
This Piston Aids Ring Job

If your car were fitted with the pistons invented and patented by Samuel Bowles, of Indianapolis, it would be much simpler to renew the rings. Only the cylinder head would have to be removed—there would be no need to drop the pan.

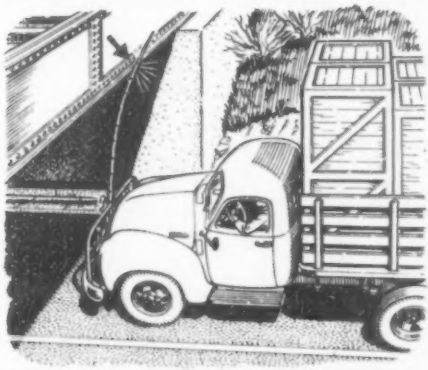
As you can see from the photo, the piston consists of two parts: the skirt, and a head that screws into it. Two screws lock the two parts together. The head—and the rings—can thus be taken off without disturbing the rest of the assembly, the designer claims.

Hints from the Model Garage

Finding High-Voltage Leaks. If you suspect there are shorts in an engine's high-voltage system, suggests John Vincenti, of Kennett Square, Pa., start it up in total darkness and take a look. You may find sparks flying from many unexpected places—wires with worn insulation, dirty plugs, or cracked distributor caps.

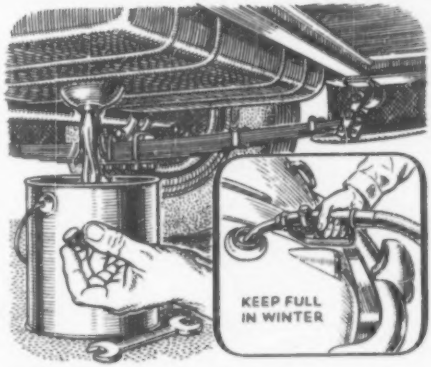


Don't Spill Fluid. A valve for filling master cylinders directly from the brake-fluid can is a useful gadget. Designed by N. E. Peeler, St. Paul, Minn., the valve keeps fluid from spilling when the can is inverted for use. It opens and the fluid is automatically released when the wire strikes the bottom of the cylinder reservoir.



Clearance Pole Warns Trucker. If you truck tall cargo that's likely to become entangled with low bridges and wires, you might borrow an idea from the family cat. Attach a bamboo fishing pole to the front of the truck as a warning "whisker." Make it a trifle taller than the load.

Approach a bridge or overhead obstruction slowly. If you hear the tip strike or see the pole bend, you can stop the truck in time.

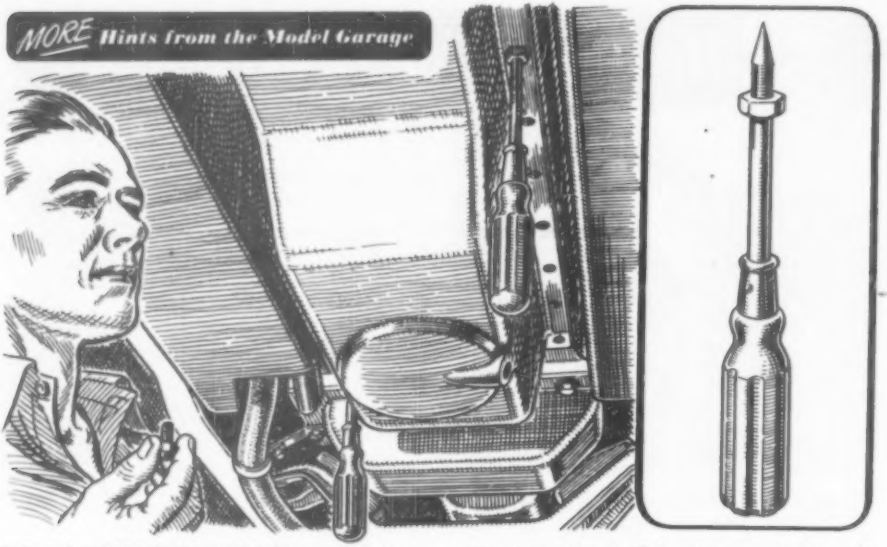


Drain Tank Once a Year. This is a preventive-maintenance step that's frequently neglected. The purpose is to drain off accumulated sediment and water. Most fuel tanks have some sort of a plug to make the job easier.

A good cold-weather habit is to keep the tank as full as possible at all times. This will help prevent moisture from condensing inside the tank.

Turn the Page for Three More Hints

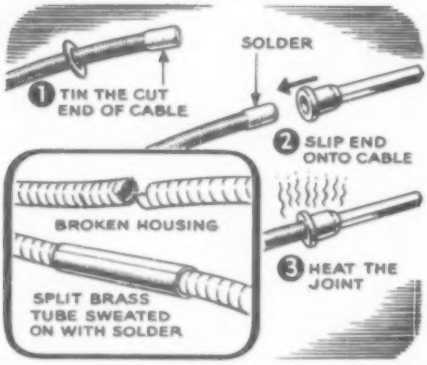
MORE Hints from the Model Garage



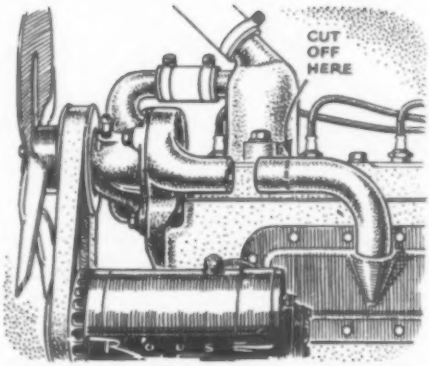
Tired of Holding Up Pans? Like a lot of other mechanics, John H. Miles, of Springfield, Mo., found it awkward to hold up an oil pan with one hand and start the bolts with the other.

But he no longer does the job that way. Taking two screwdrivers with shanks the same size as the pan bolts, he ground the ends sharp, cut standard threads down about ¾", and added a nut to each for a shoulder.

Now he puts the pan in place, pushes the sharp-pointed converted screwdrivers through two holes, screws them up snug, and then starts the bolts at his leisure.



Solder Speedometer Cable. In some speedometer-cable replacement kits, you find instructions to cut the cable to length and attach the tip by crimping. L. M. LaBar, of West Pittston, Pa., finds it's better to tin the end (1), slip on the tip (2), and sweat it fast (3). A broken cable housing (inset) can also be repaired by tinning a split brass tube inside and sweating it on the break.



Replacing Water-Pump Hose. On a 1941 Hudson, this usually requires removal of the pump. Marion L. Rhodes, Knightstown, Ind., suggests removal can be avoided by cutting 1" off the block connection. Leave the clamps on loosely, apply sealer inside each end of the new tube, and slide it on the block connection far enough to let the other end slip on the pump outlet.

Mechanics and Handicraft

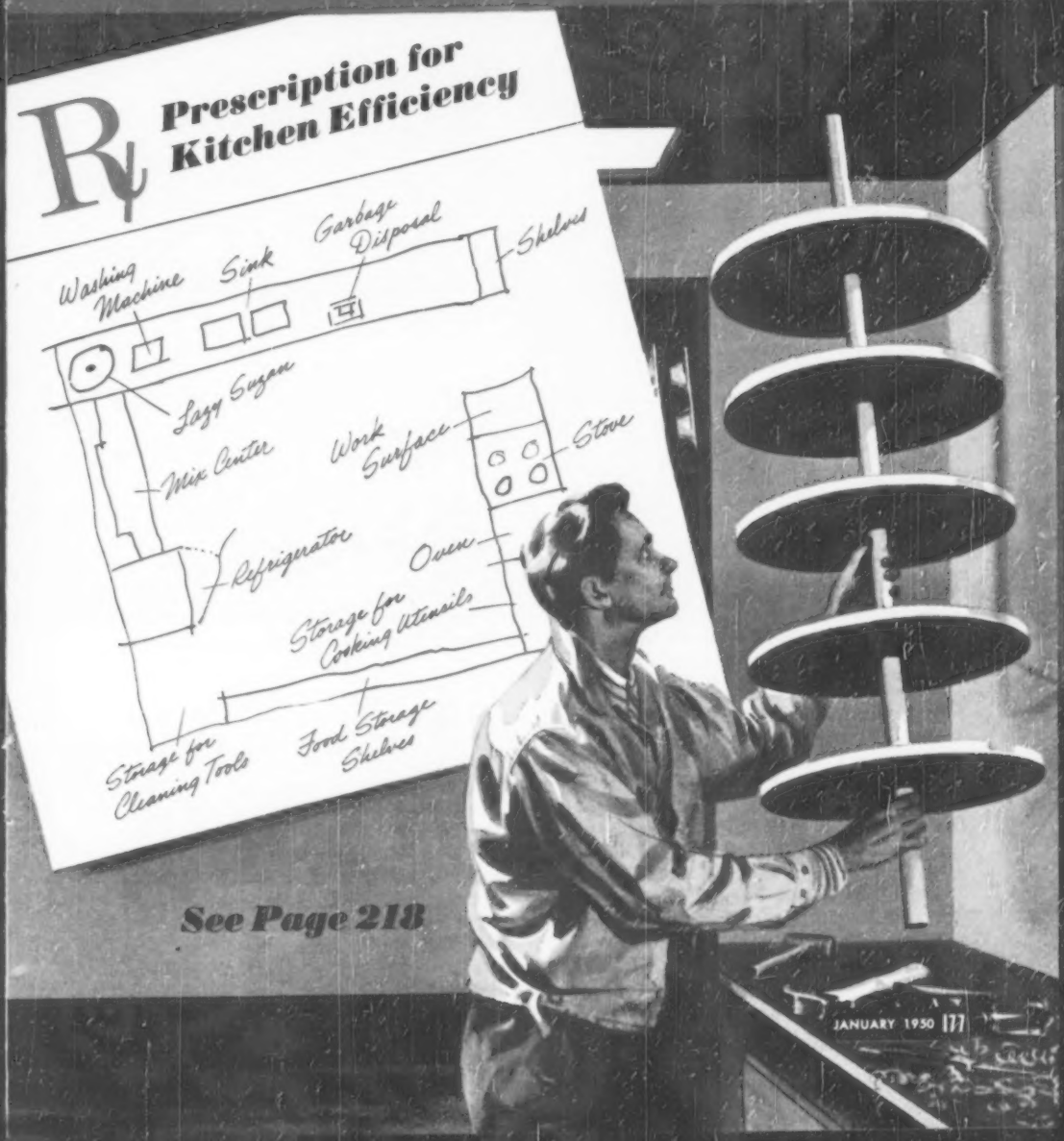
Car Unlocks Garage Door PAGE 176

Almanac for Householders PAGE 197

How to Overhaul a Fuel Pump PAGE 226

Modernizing Your Phonograph PAGE 229

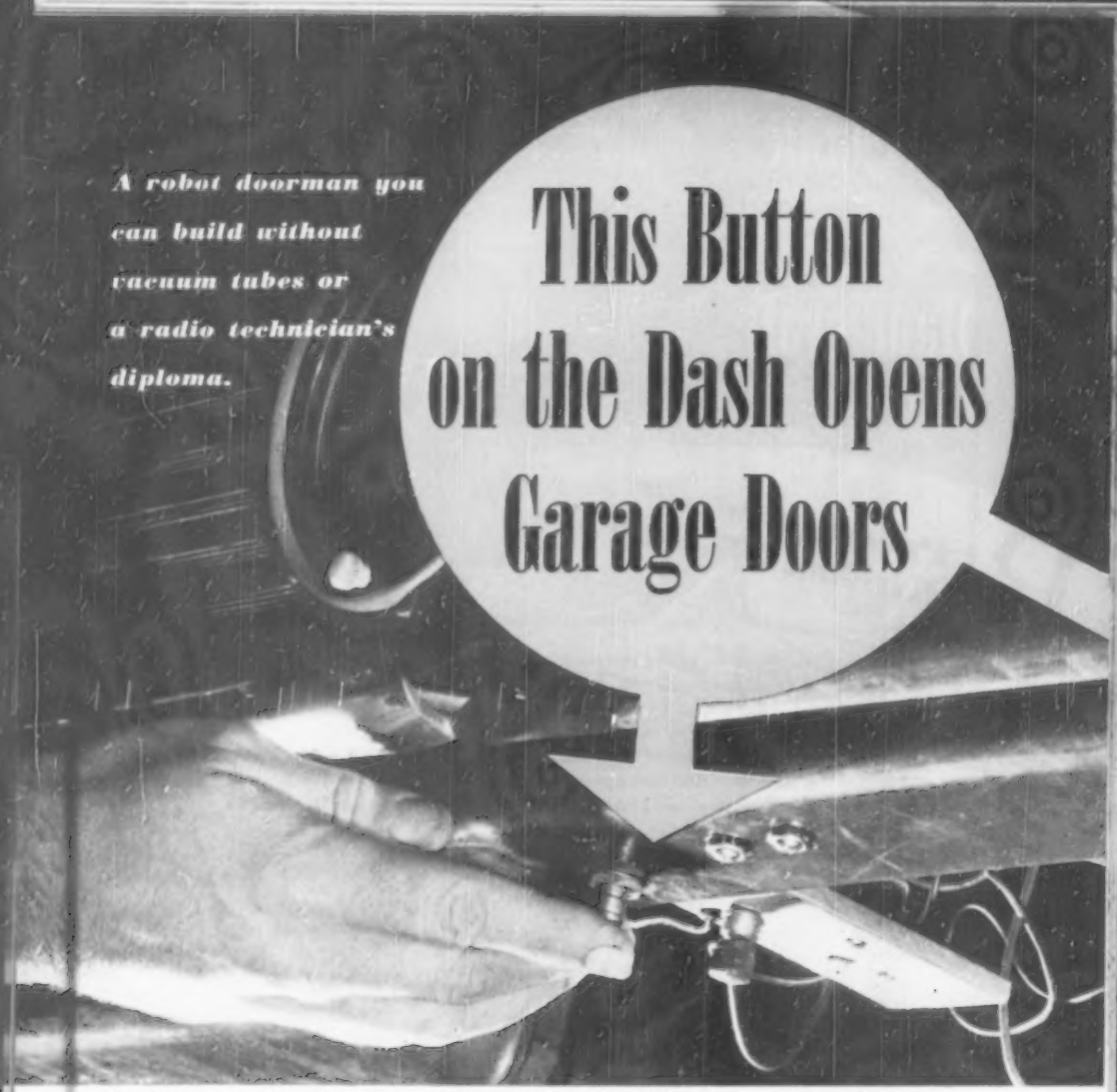
Turning Disks and Bowls PAGE 236



See Page 218

A robot doorman you can build without vacuum tubes or a radio technician's diploma.

This Button on the Dash Opens Garage Doors



Service at your finger tips. Push this button in the car either to open or close the garage . . .

By J. Raymond Schneider

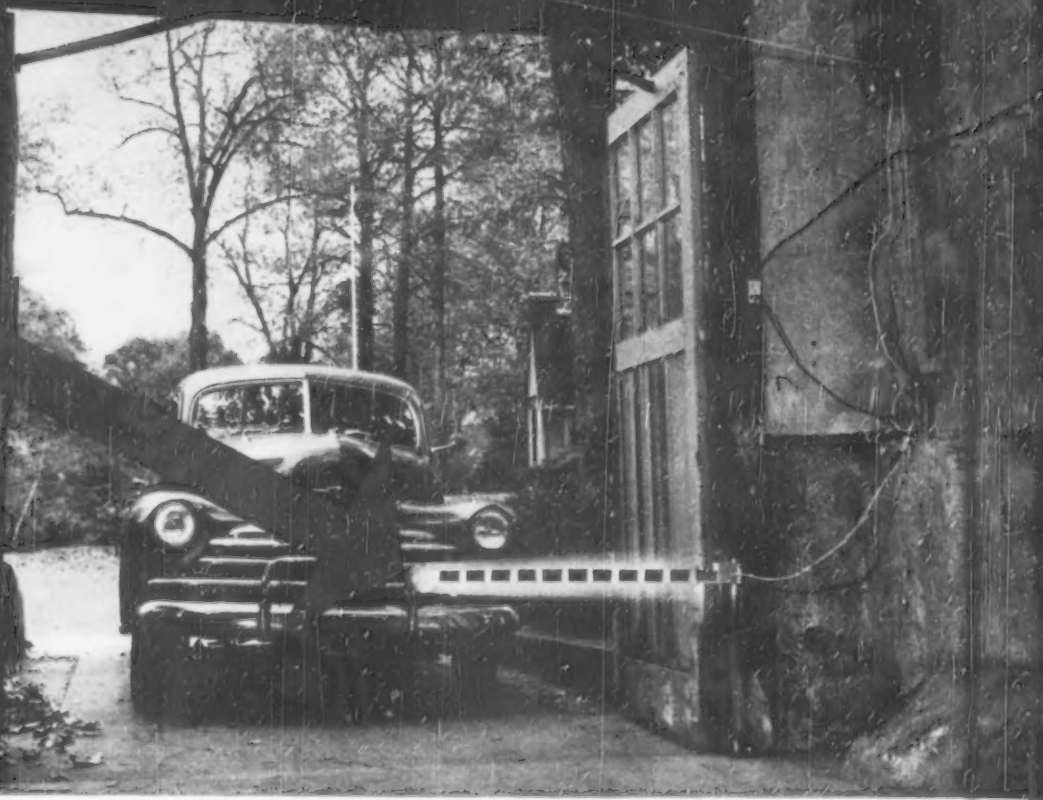
DOES your motoring day start like this? Open the garage doors. Get in the car and back it out. Climb out, make a detour around the front fender, and close and latch the doors. Dodge the fender again and get in. On returning, reverse the whole routine.

That's how I used to do it.

Today I walk into my attached garage from the house and touch a button. While the doors open, I get in the car. After backing it out, I pause long enough to touch a second button, under the dash. A spotlight on the car winks—and the doors close.

They lock, too. You can't get in from outside unless you have a key or drive up in my car. Headlights or an ordinary spotlight won't work. The rig takes no juice when it's standing by, because there are no vacuum tubes to be kept hot. But when I get back from a trip, whether in minutes or a month, it opens the doors at a touch of the button.

The dash button sends juice to the light and to a magnet that pulls a thin spring or reed on which a contact is mounted. This



. . . And a spotlight winks rapidly, exciting a photo cell that starts an automatic operating cycle.

breaks the circuit until the reed, released, closes it again, just as in a doorbell. Thus the light blinks at the reed's frequency.

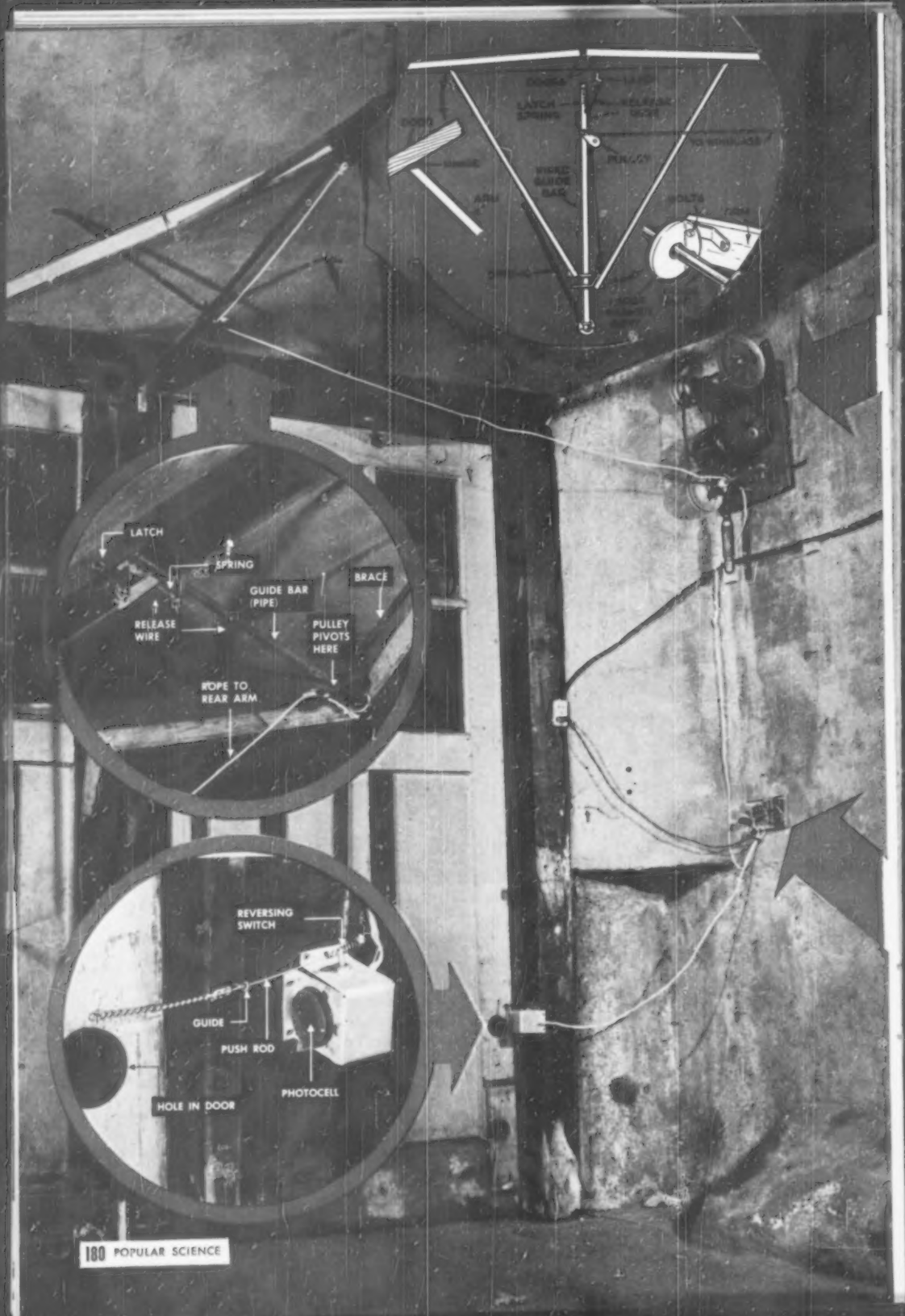
As the beam hits a photo cell on the garage, this generates a pulsating current that is fed into a coil of fine wire fixed on another, similarly tuned reed and poised over a permanent magnet. The current vibrates the reed at the same frequency, until it swings far enough to touch a contact that closes a 115-volt relay and starts the door mechanism.

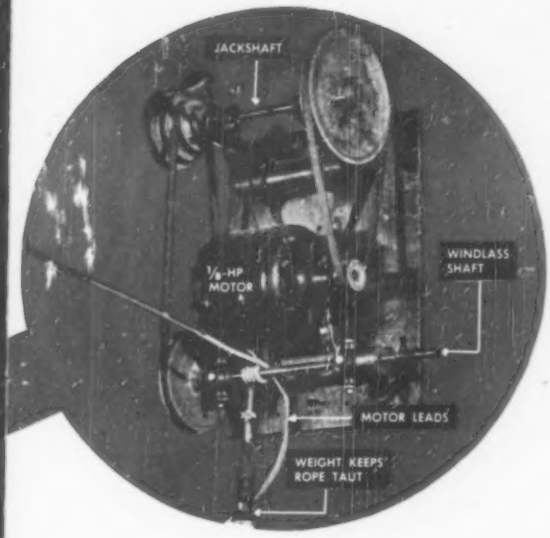
A steady light, or one of the wrong frequency, will agitate the resonant reed but won't swing it far enough to make contact.

Power unit. A ⅙-hp. motor is the muscle that moves the doors. It's belted through a jackshaft to run an output shaft at about 175 r.p.m. Plain pillow blocks will serve instead of the adjustable jackshaft and self-aligning bearings shown.

The rope that pulls the doors is simply looped four times around the windlass shaft and tied to a weight that hangs close to the wall. This gives plenty of traction but will slip if something jams.

Door linkage. A piece of pipe set in


LATCH
SPRING
GUIDE BAR (PIPE)
BRACE
RELEASE WIRE
PULLEY PIVOTS HERE
ROPE TO REAR ARM
REVERSING SWITCH
GUIDE
PUSH ROD
PHOTOCELL
HOLE IN DOOR



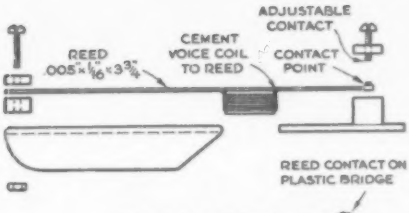
the center of the door lintel is fastened by an elbow and a short length of pipe to the garage ceiling. On this slide two large, loosely fitting washers bent to an angle along one side and bolted to wooden thrust arms.

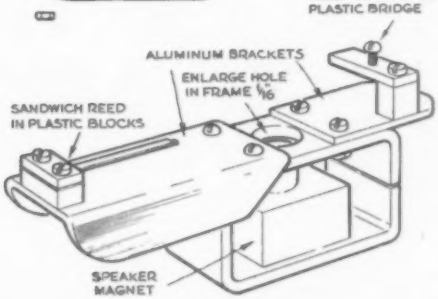
One washer necessarily slides behind the other. The rope from the power unit is fastened to the rear washer. As this is pulled forward, it pushes the other before it.

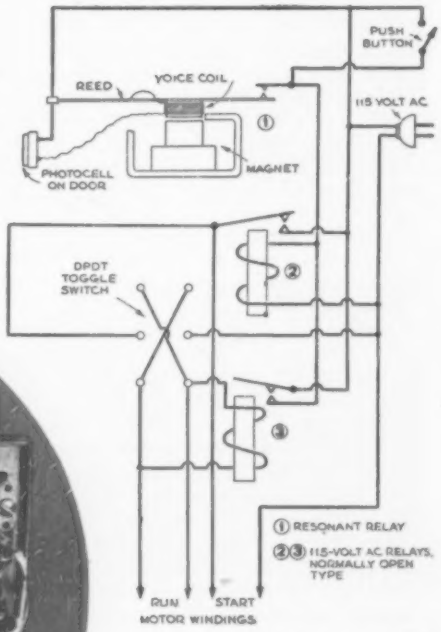
The wooden arms are pivoted on the doors by small hinges. A long spring holds the forward thrust arm back against the other thrust arm, so that the two move back together as the doors close. This spring is not powerful enough to drag the rope around the windlass and lift the weight. Thus the doors stay open until the motor reverses.

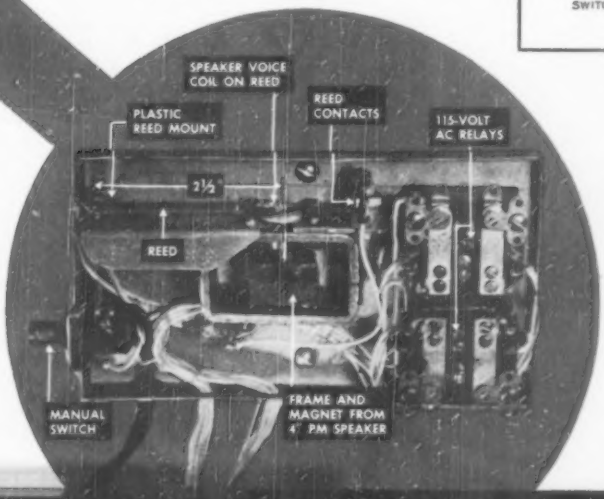
Any devices for holding the doors open must be removed. The center latch that secures one door shut is wired to a pivoted pulley over which the windlass rope runs. Being attached forward of the pivot point, the latch wire is tripped as soon as the rope pulls. A lock on the latched door enters a strike on the other, locking both.

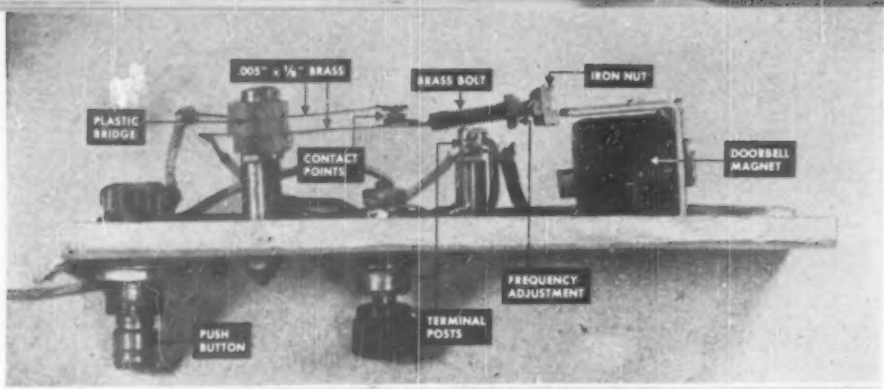
Reversing switch. This is a double-pole, double-throw toggle switch of a rating high enough to handle the motor current. It's mounted on the door jamb atop a box that also houses the photo cell.

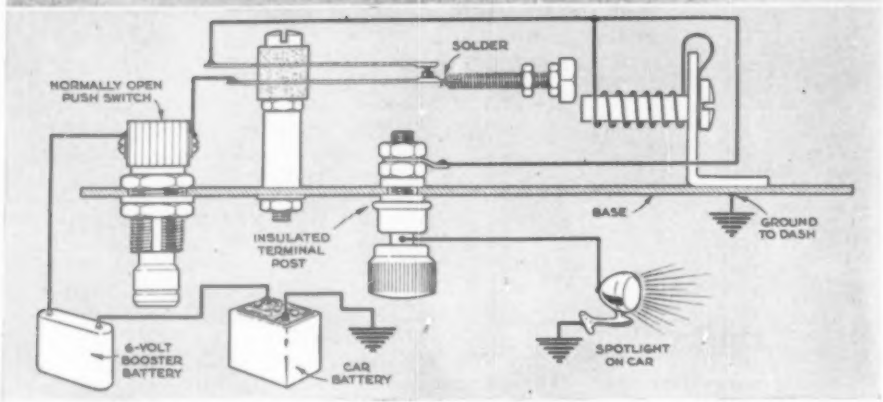












A hole is drilled through the toggle arm parallel to its throw. A stiff wire through this is fitted with two stop collars and a spring, goes through a guide eye in the jamb, and is fastened to a small chain attached to the door. Proportion the wire and chain so that they snap the switch forward just before the door is wide open. This will stop the motor by opening the circuit for an instant, thus opening the power relay, and at the same time reverse it for the next half of the cycle. Set it so the door hits the end of the wire and flips the switch back just before it's fully closed.

Photo cell. This is an inexpensive selenium barrier-layer type, which generates a minute current when light strikes it. Bore a hole in the door for the light beam.

Spotlight blinker. This unit, which goes in the car, has a reed—a thin metal strip—that is vibrated by an electromagnet. Contacts on the reed open and close both spotlight and magnet circuits. The reed and its upper contact strip are sandwiched between plastic or fiber strips bridging two bolts. Contact points from an old relay or vibrator are soldered on. Adjust the reed, by turning the nut at its outer end, to vibrate six to eight times per second.

Since the spotlight current is intermittent, around 12 volts must be supplied to the 6-volt bulb to bring it up to full brilliance for exciting the photo cell. The easiest way to do this is to hook a 6-volt dry battery or four large dry cells in series with the car battery. The light is on only a second or two at a time, so they should have long life.

Resonant Relay. Triggered by photocell current, this is the control center in the garage. The permanent magnet of a junked 4" radio speaker was pried out of its bracket so that the bracket hole could be filed to a free fit for the voice coil. Then the magnet was cemented in place again. The reed itself forms one voice-coil connection; use fine wire for the other.

Adjust the reed to the same frequency as the blinker on the car by observing the reed in the spotlight beam, preferably at night, while tapping the reed with a finger. When in tune, the vibrating reed should appear still or nearly so because of the stroboscopic effect of the blinking light. Tune it by adding solder, or adjust the blinker reed.

Wiring. Remember the motor must turn to close the doors with the reversing switch flipped toward the door. Should you wire it backward, just loop the rope the other way on the windlass shaft.

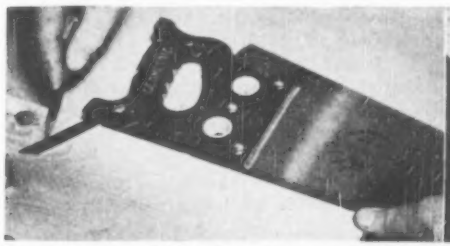
You can adjust the resonant-relay contact so that the photo-cell current closes it in from a tenth to a full second. Half a second is about right. Closer adjustment may make the relay too sensitive to shock and vibration.

The reed contacts activate relay 2, which then sends current into the reversing switch. Besides starting the motor, this energizes relay 3, whose contacts shunt those of the reed and hold relay 2 shut after the reed stops. As the doors reach the end of their travel and flip the reversing switch over, the toggle throw cuts current to relay 3 momentarily, which opens relay 2, leaving all at a standstill until the resonant relay or garage button starts a new cycle. This button can be placed wherever convenient. END

Here saw is used as outside square. Back edge of carbon-steel blade is ruled on each side.

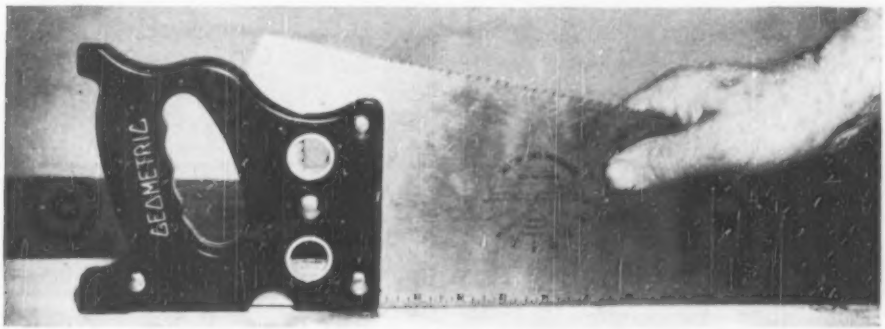
New Saw Does Five Jobs

A COMPLETE layout tool is built into this handsaw, made by the Geometric Saw Co., Inc., Auburn, N. Y. It's priced at about $10. You can use it as an outside square, a level, an inside square or plumb, a protractor, and a floor saw or other surface cutter. Etched on each side of the blade are rule divisions in sixteenths. Teeth on the rounded blade point permit you to cut through a surface without drilling a hole and using a compass saw.



Protractor is calibrated in 15° intervals. Stainless-steel pointer folds out of the plastic handle.

With the surface-incision point, you can cut into a floor or wall without drilling a hole.



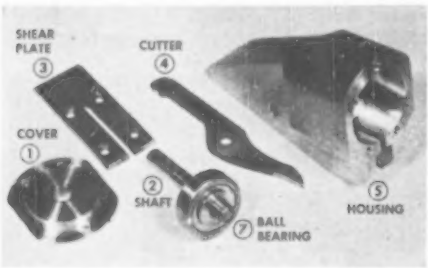
Used as a level. With other bubble and rear of handle, saw serves as inside square or plumb.

Your Electric Drill Can Cut Sheet Metal

By J. C. Magee

EASIER to handle than a pair of snips, this power shear does everything you'd expect from the snips—and more. On inside cuts—for instance cutting an opening in a furnace duct—you simply drill a starting hole, insert the blade tip, and make the cut. Such jobs are always difficult with snips.

You guide shear with one hand, hold the work with the other. An eccentric vibrates blade.



Five major parts require machining. These are keyed, above, to drawings on the facing page.

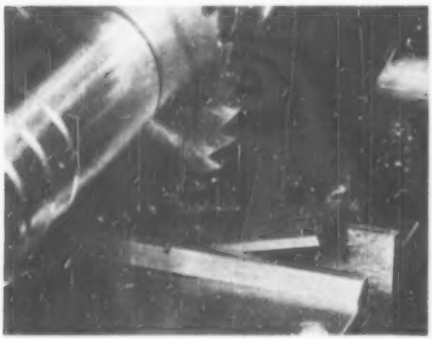
Hitched to your ¼" electric drill, the shear will make straight or contour cuts in brass, aluminum, or steel up to .040" thick. With a larger drill, the shear will handle heavier gauges.

The cutter blade and shear plate are made from .093" ground stock—tool steel that's precisely finished on both faces and readily hardenable. The blade is a file job. Maintain a sharp cutting edge and file in full clearance so you'll get good contour cutting action. While hardening and drawing the shear plate, wedge a 3/32" bar in the slot to keep it from closing.

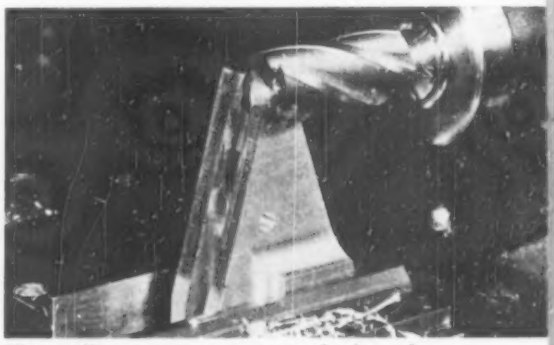
In turning the cover, keep the bore for the bushing concentric with the 1"-dia. shoulder. To turn the off-center part of the shaft, chuck it with a thin strip of steel under one jaw of a three-jaw chuck. Mill or file three flats 120° apart on the shaft to give the drill chuck a good grip.

After machining the housing block to 1¼" by 1⅞" by 3¼", bore the 1" hole before milling the angles. The seven screw holes can be spotted from parts 1 and 3, using part 4 to line things up. In assembling the shear, note that the blade must never close fully. This allows it to hook into the work.

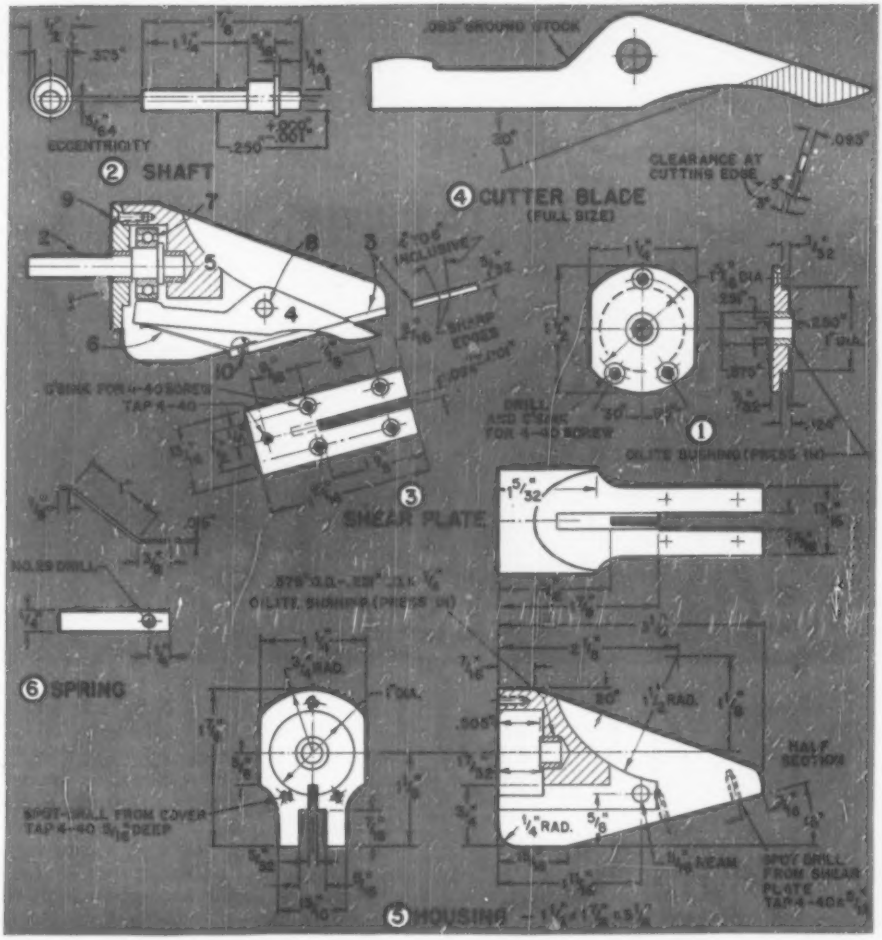
The spring should be just strong enough to return the blade to open position. Corset steel will do nicely.

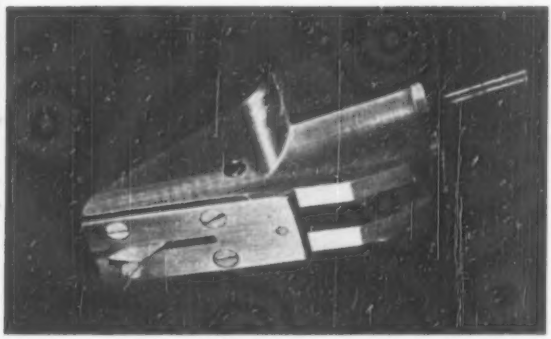


Shear-plate slot is milled with 3/32" cutter. With this diagonal setup, a 3"-diameter cutter is large enough to mill the slot 1⅛" long.



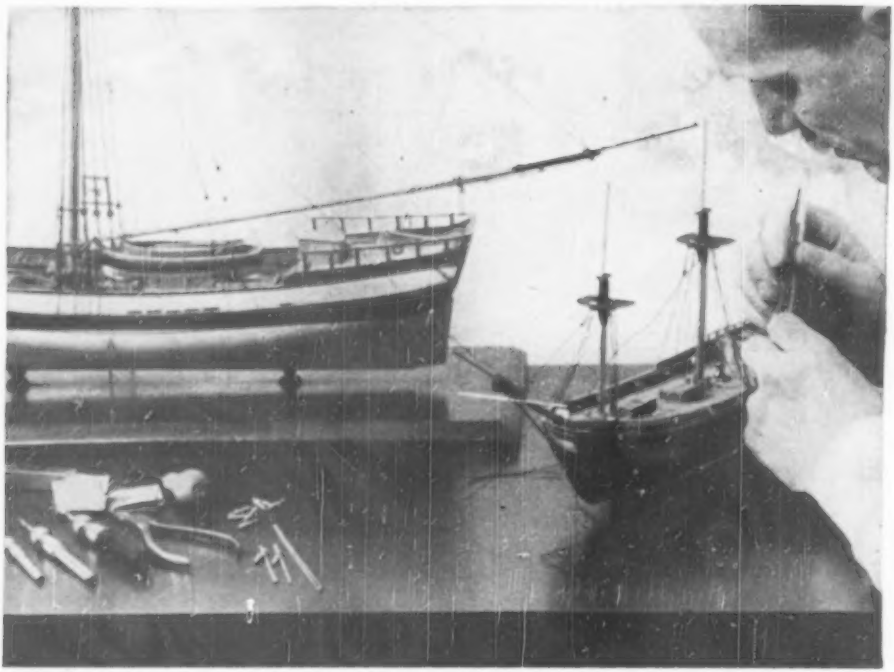
This milling setup gives a nice finish to the sides of the dural housing. The hole for the 3/16" by ¾" dowel pin has already been drilled.





Tip of blade, in closed position, should rest 3/32" from shear plate. In assembling shear, put a few drops of oil on all the bearings.

MATERIAL LIST		
PART		MATERIAL
1	Cover	Alum. Alloy
2	Shaft	Drill Rod
3	Shear Plate	B. & S. Steel
4	Cutter Blade	B. & S. Steel
5	Housing	Alum. Alloy
6	Spring	Spring Steel
7	Ball Bearing 77R6	New Departure
8	Dowel Pin 3/16" x 3/4"	Hard Steel
9	4-40 x 3/8" Flat-Hd. Screw	Steel (7 Req.)
10	4-40 x 1/8" Round-Hd. Screw	Steel
	7/16" Dia. x 1" Bushing Mat.	Oilite

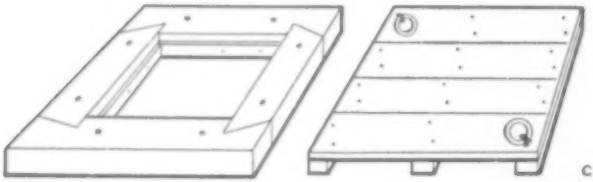


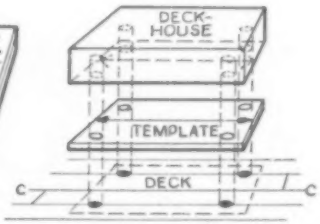
Tricks of Master Shipbuilders

More than twenty-five years of experience are behind these helpful hints.

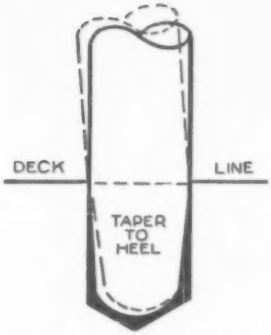
LIKE almost any craft, ship-model building has its own special skills and methods—and masters who developed them. Winthrop Pratt, Jr., of Dorchester, Mass., for example, has devoted over a quarter century to building and restoring models of sailing ships. Recently he rebuilt an 18th Century ship model for the Boston Museum of Fine Arts.

On these pages are some of the kinks and ideas he's developed. The deadeye clip, for example, has brought Pratt more inquiries than anything else. You can really line up deadeyes and set up lanyards with it.

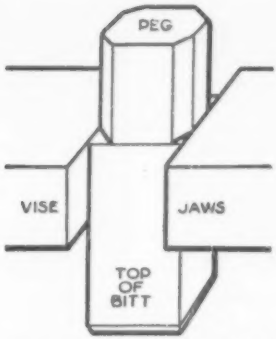




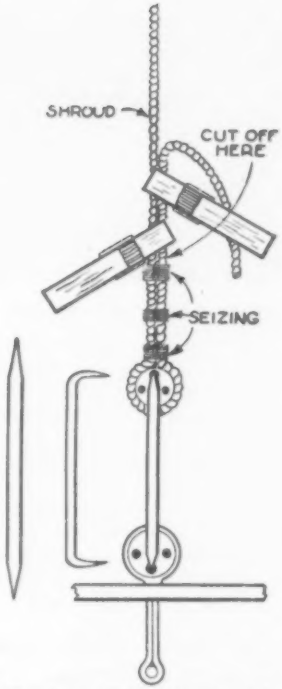
Hatch coamings on 17th and 18th Century warships were often less than 6" high. Joints shown at left are from an early 18th Century ship. Center: small hatch covers were often like this. Beams ran athwart ship and mortises cut in hatch lining received them. Drawing at right shows you how to blind-dowel a deckhouse to a deck. Tape cardboard template to bottom of house. Drill house for dowels. Then use holes in template to drill deck holes.



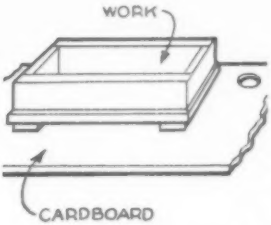
Stepping masts. Drill hole same size as mast. Give mast a slight taper from deck line to heel. Round the heel. Mast then can be moved slightly in any direction, permitting you to line it up true. Truing up masts in tight holes results in unsightly bends a few inches above the deck.



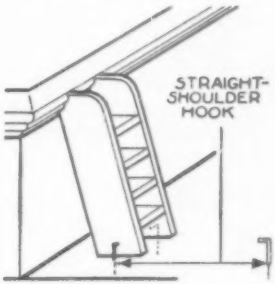
Bitts and stanchions. Put bitt in vise upside down. Round off peg with flat file. In a thin piece of hardwood, drill hole slightly smaller than peg. Twist pegs through this hole. This will make all pegs of equal diameter and they will fit in holes drilled in the deck with the same drill.



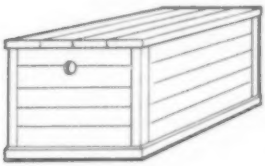
Deadeye clip. This gimmick will keep deadeyes evenly spaced and still let you set up lanyards properly. File ends of tempered wire to fine points and bend the points at right angles. Distance between points equals three or four diameters of a deadeye. Insert clip in deadeyes. Bring shroud around upper deadeye and clip it to standing part with clothespins. Seize the shroud. Then take out clip and reeve deadeye lanyard. Put drop of glue on each seizing and clip off surplus shroud when the glue is dry.

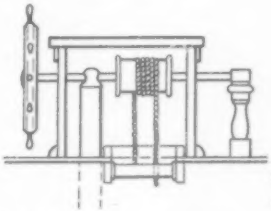


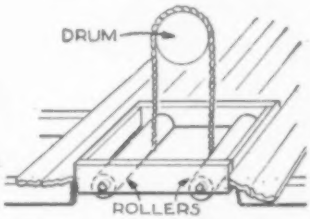
Painting tiny parts is easier if you glue pieces of cardboard under each corner. Glue these, in turn, to a larger piece of card. The little pieces raise the work and prevent paint from forming a ridge around the bottom of the work. Remove the cardboard afterward.



Fastening ladders. Cut upper part of ladder to fit molding. Drill holes in each side of the ladder. Directly below those holes, drill holes in the deck. Cut heads off two pins and bend at right angles. Insert pins in ladder sides and push points in deck as shown.





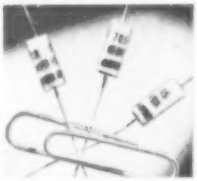


Small ships were steered directly by tiller. But as ships became larger, some method of steering from topside was needed. Drawing at left shows common type of wheelbox on American ships before patent-gear apparatus came into use. Center drawing shows port side of wheel. Drawing at right shows hatch and rollers for wheel ropes. For model-builder's convenience, rollers can be fitted into hatch framing and the whole assembly installed as a single unit.

Tape Antenna Slides Out

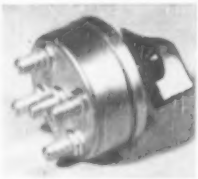
THIS flexible steel band that slides in and out of a small metal case serves as an adjustable antenna for FM and television. Individual markings on the tape show the best length for each of the 12 TV channels. Pulling one side automatically brings the other to the same length. Both loops of the folded dipole are retracted by pressing a lever on the case. The Radio Craftsmen, Inc., Chicago, makes the antenna, which retails for about $10.

New-Style Germanium Diodes

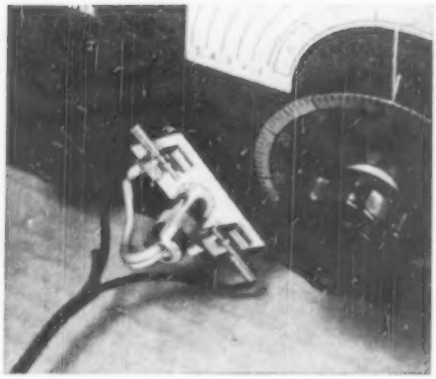


WAR-DEVELOPED crystal diodes are now available in hermetically sealed moisture-proof glass cartridges (top photo) and in an ultracompact form (right) suitable for miniature equipment. The sealed-in-glass units are made by Sylvania; the tiny diodes are a Raytheon product. The latter measure only .16" in diameter and .39" long.

Switch Joins Co-ax Feed Lines



UP TO four antenna transmission lines can be joined to a receiver with this coaxial switch. Special fittings are screwed to the threaded studs, and the switch then links any one of them to the input circuit of the set. It is priced at $12 and made by Workshop Associates, Newton Highlands, Mass.



Plug Connects Standard Phone Tips to Two-Way Jack

ONE good pair of headphones can be used on many different pieces of equipment—but switching from phone tips to a jack-type plug is likely to be time consuming. Here's a simple adapter that gives you a change-over in a jiffy. Take a small piece of ⅜" plastic, and mount a standard jack in the center of the strip and a Fahnestock® clip on each side of it. Connect one clip to each jack terminal. Phone tips then can be slipped into the clips.—*James Colton, Boston.*

The Height of Ingenuity

I borrowed a projector to show some movies at a party. But I forgot the screen. Here's what I used in the emergency.

Everybody wanted a bite to eat and a drink, anyway, so we moved the whole party to the kitchen and used the front of the refrigerator as a screen. It worked fine.
—John Kakalec, Washington, D. C.

Seeing What Goes On Inside Your Car Engine

By Kenneth M. Swezey

BEHIND all the complicated mechanisms under the hood, in the chassis, and on the dashboard of your car lie simple and fundamental principles of physics, mechanics, chemistry, and electricity. Some of these were discovered hundreds or even thousands of years ago by such pioneers as Aristotle, Archimedes, Newton, Faraday, and Bernoulli. Many can be demonstrated dramatically in experiments you can perform in your own home.

On this and the next two pages, POPULAR SCIENCE shows you a few simple demonstrations of basic automobile principles that father and son—or even the whole family—might enjoy performing together. Your laboratory can be the kitchen or rumpus room; your apparatus such things as soda straws and tumblers, candles, and tin cans.

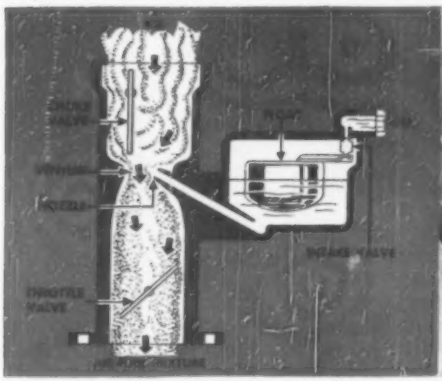
Let's start by looking inside the carburetor. With two halves of a soda straw and a glass of water, you can show how air streaming through this device lifts gasoline, scatters it as vapor, and mixes it with air.

After flattening one end of each straw, stand one in water and hold the other horizontally, flattened ends together. Now blow strongly through the horizontal straw, aiming the air across the tip of the other. Water will climb up in the vertical straw and spray out.

The secret? Daniel Bernoulli, famous Swiss scientist, discovered it more than 200 years ago. Increase the velocity of a fluid (such as air or water), and the pressure inside that fluid will be *decreased*.

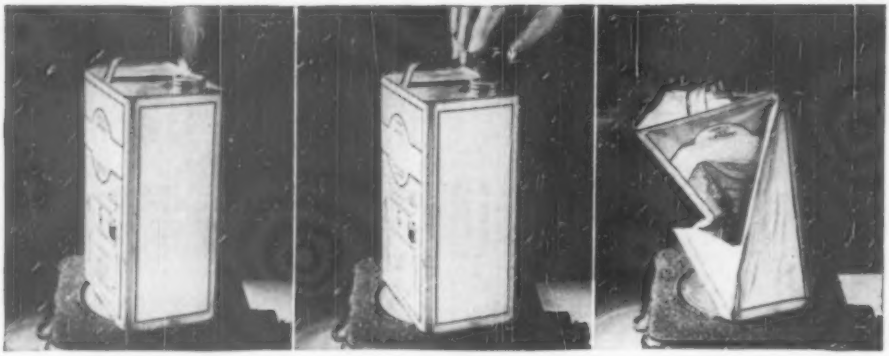
According to this principle, air speeding over the tip of the vertical straw is at a lower pressure than that of the still atmosphere. Since the atmospheric pressure on the water in the glass is greater than the pressure at the tip of the straw, water is pushed up into the air stream.

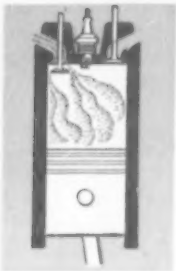
For some other unusual demonstrations of auto principles, turn the page.



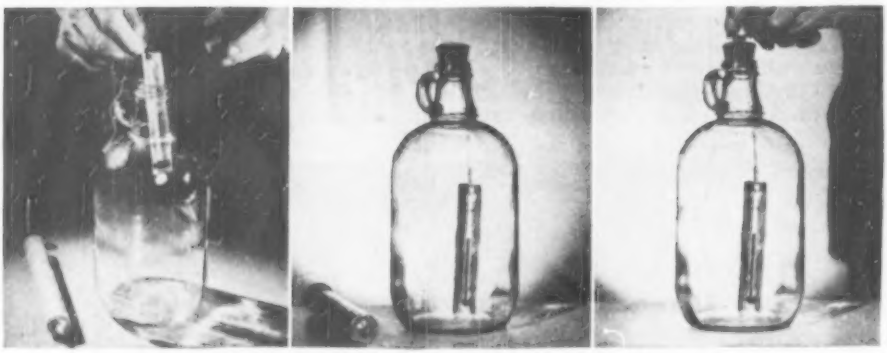
In a carburetor, air from the atmosphere must pass through a constricted tube, or "venturi," to reach the engine. This constriction speeds up the air, and the suction it creates pulls droplets of fuel from the nozzle. The mixture of air and vaporized fuel is highly explosive.

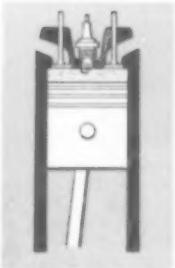
The venturi principle is shown graphically by this simple experiment. Air speeding across tip of vertical straw causes water to rise in it, emerge, and be sprayed out. Gasoline is similarly raised and vaporized. It's then ready to enter cylinder, as on next page.



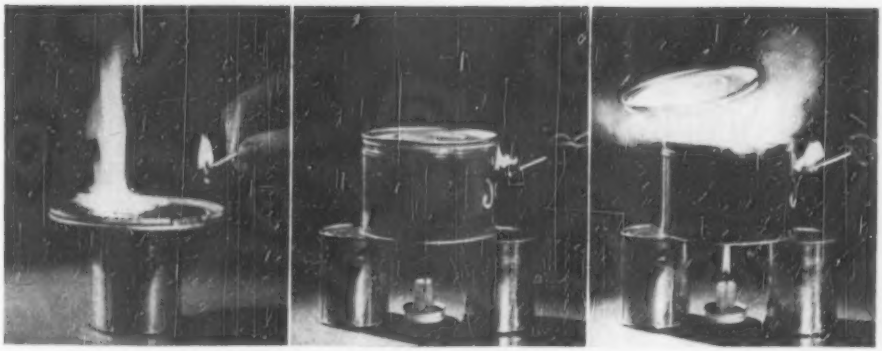


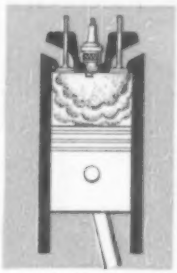
INTAKE To give power to your car, its engine repeats over and over the four-stroke cycle shown in the diagrams on these two pages. On the intake stroke, the cylinder is filled with the gas-air mixture from the carburetor. From a design standpoint, the big problem is to supply enough air. In fact, a big roomful of air must be crammed into the cylinders for each gallon of gas. Atmospheric pressure of nearly 15 lb. per square inch does the trick. You can demonstrate this pressure. Put a half inch of water in a flat-sided gallon can and boil rapidly. Remove from the heat and cap quickly. The steam inside condenses and internal pressure drops rapidly, leaving the can unsupported. Then tremendous outside pressure crumples it.



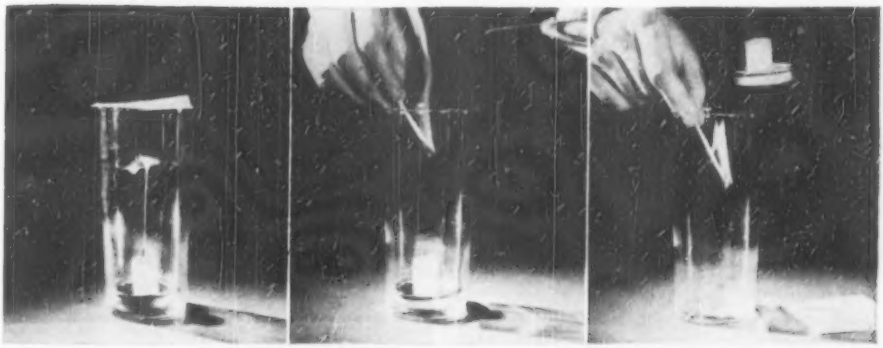


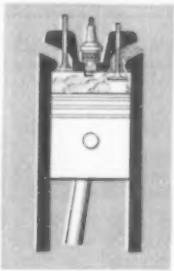
COMPRESSION Although gas and air will burn at atmospheric pressure, more power results if the mixture is squeezed by a compression stroke. Theoretically, the greater the squeeze the more the power. Practically, the amount is limited by the tendency of gasoline to explode prematurely from the heat of compression. Such premature explosions are one cause of "knocking." That gases heat when compressed can be shown by suspending a thermometer in a half-gallon jug and squeezing the air in the jug. Note the normal temperature first, then insert a bicycle-pump nozzle through the stopper. Pump about 15 strokes. (No more, or you may blow out the cork or break the jug.) The mercury will climb a degree or two.





POWER In the power stroke, a spark ignites the gas-air mixture, causing it to explode (more accurately, burn very fast) and drive the piston downward. *Because gasoline is too dangerous to play with, especially in the house, you had better not try this experiment, but the photos above show what happens.* In your car engine the gasoline must be vaporized. Liquid gasoline burns, as you see at the left, but not fast enough. At the center you have a situation comparable to a cold engine. In the can are a few drops of gasoline, but the vapor given off is so meager that nothing happens when a match is held to a hole in the lightly-covered can. But if the can is heated with a candle, as at the right, an explosion blows the lid off the can.





EXHAUST To prepare the cylinder for the next intake, an exhaust valve opens at the end of the power stroke and the spent gases are pushed out. Unless these burnt gases are forcibly removed, some would remain to prevent efficient combustion. It is easy to prove how this would happen. Light a short candle, fix it to a jar top fitted with a wire handle, lower the assembly to the bottom of a tall tumbler, and cover the tumbler with a piece of cardboard. As soon as the candle goes out, slide off the cover and lower a lighted match into the glass. Lacking oxygen, the match flame goes out. Now remove the burnt air by pulling out the jar top. Again introduce a lighted match. This time it continues to burn. END

You Can Make a Lamp Out of Simple Things

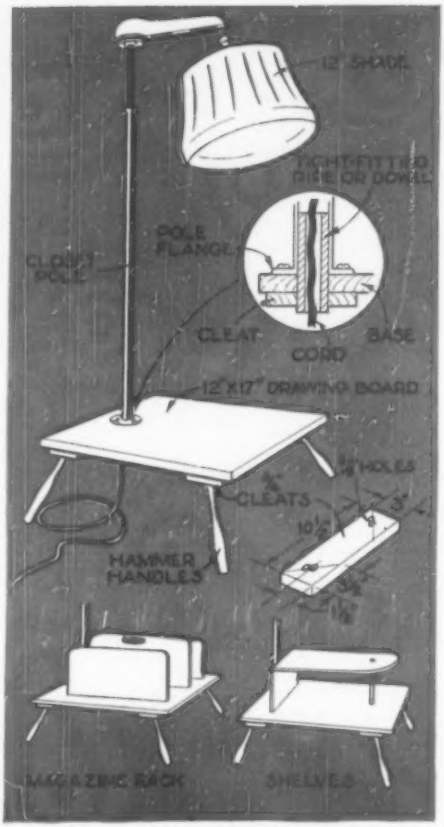
WITH the kitchen table as my workbench, I put together dime-store parts to turn out this convenient lamp table.

The shade is adjustable from 44 to 69 inches and can be swung around for better lighting. There's room to park a radio, sewing basket, or books on the base. Here's what you need:

- A bread board or drawing board to serve as the base.
- Hammer handles for legs.
- A telescoping metal closet pole for a standard.
- Half a wooden coat hanger to support the shade and socket.

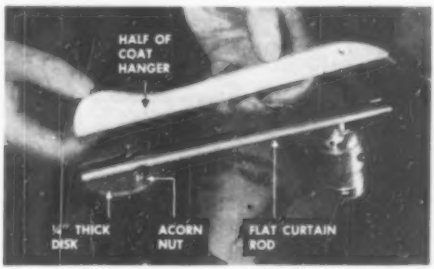
You'll also need lamp cord, a few screws, glue, and a short piece of flat metal curtain rod. This fits under the half coat hanger and hides the cord that runs up the standard to the socket.

Start by making the cleats. Almost any wood from ½" to ¾" thick will do. Drill two ⅝" holes in each cleat as indicated in the drawing. Then shape the holes with a file until the head ends of the hammer handles fit in. Saw the ends of the handles at an angle, so they slope about like those shown in the photo and drawing. Screw the cleats to the base and then glue the legs in place.

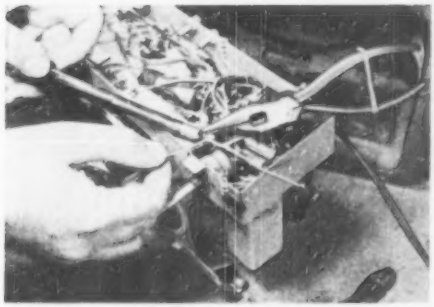


Construction details of the arm are shown in a photo below. Cut a disk from plywood or composition board to the pole-flange diameter. To this disk, screw the flat curtain rod and one flange of the closet pole. The other flange is screwed to the base.—*Arthur Miller, Manhattan, N. Y.*

Mixture of sawdust and glue was used to secure legs in cleats. Sawdust gives body to the glue and fills around legs better than glue alone.



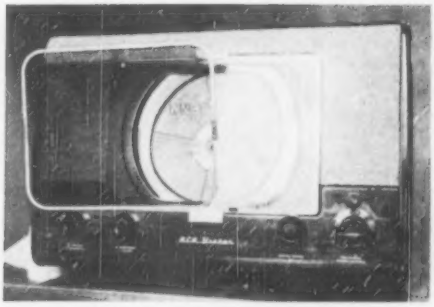
Cord runs up inside standard, through hole in plywood disk, and then to socket. Flat curtain rod on underside of arm conceals the cord.



Heat Thief Protects Parts

MANY parts used in radio work are highly sensitive to heat. Too much of it can easily damage such items as germanium diodes, crystal phonograph cartridges or microphones, and subminiature tubes.

Thus special care is needed if you use a large iron to solder such parts into a circuit. One aid is to clamp a pair of long-nose pliers to the lead being soldered and hold it in place with a rubber band around the handles. The pliers' relatively large mass of metal "bleeds" excess heat away rapidly.



New Filter Cuts TV Glare

A NEW addition to the line of Polaroid® television filters consists of a double layer of polarizing film. A circular polarizer has been added to the linear polarizer that has been in use for some time. In combination, the two filters act as an effective light trap to reduce glare reaching the screen from external sources. The filter makes it possible for video images to appear sharp and clear even in a brightly lighted room. With mountings, filters retail from $7.50 for the seven-inch size to $27.50 for 20-inch tubes.

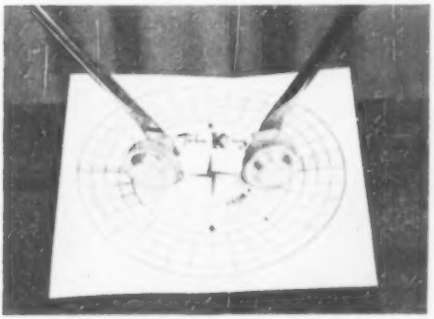


Chart Orients TV Antenna

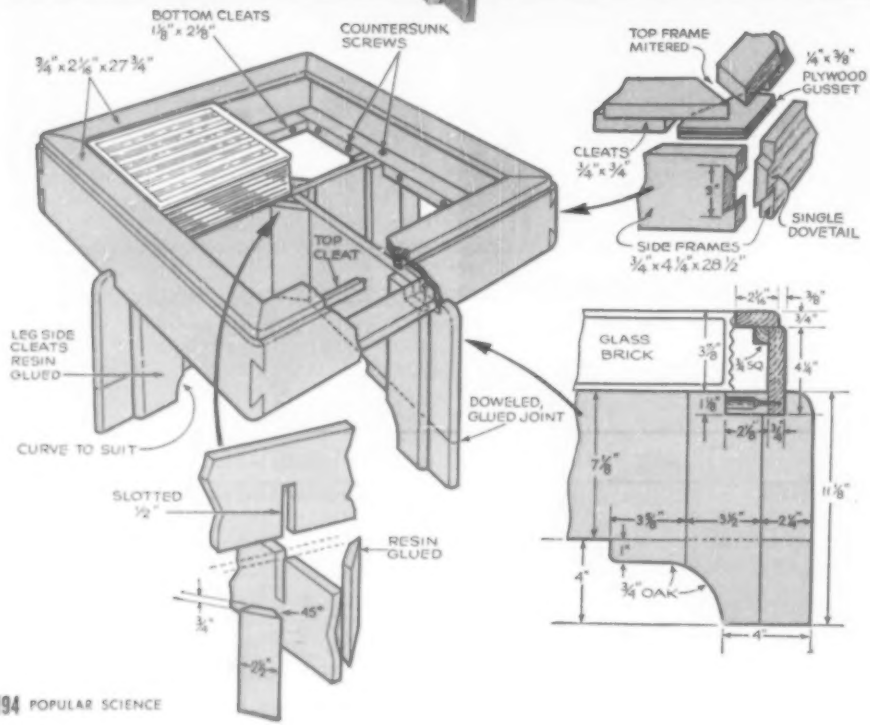
ONCE you've found the best position for this indoor TV antenna, you simply mark the channel number on the circular chart below it. Then you can turn right to it the next time. The chart is supplied with all Tele King® indoor antennas, which plug into the top of Tele King sets through the card.

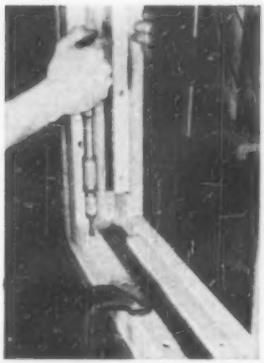
Projector Enlarges Stereos

THOSE familiar seven-scene stereoscopic slides can now be enlarged by the projector shown above. The View-Master® projector uses the same full-color slides designed for use in a three-dimensional viewer, but projects them in two dimensions instead of three. The projector sells for about $10.

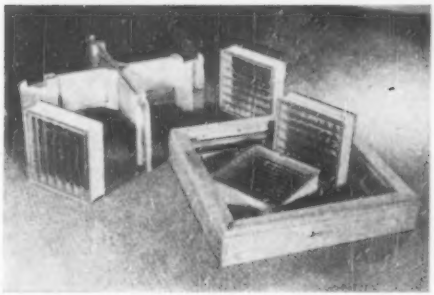
Glass Bricks Top Off Modern Coffee Table

Bold corner dovetails in a frame of light oak make this a piece you'll be proud of. Ribbed-glass top, 4" thick, is more durable than plate.

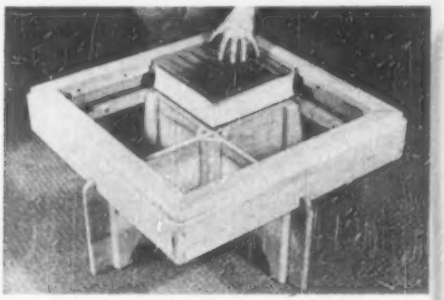




Assembling frame, left. Wood screws are countersunk. Plywood gussets already are in place in corners. Legs (above), like frame, are oak. Vertical cleats, in clamps, are glued to legs for strength.



Here are all the parts ready for assembly. By lifting out the glass bricks and removing four screws, table can be knocked down for moving.



Glass bricks need not be cemented in frame. They fit snugly and are heavy enough to stay put. Thin wood strips are wedged between them.

HERE'S modern design in oak and glass—a sleek coffee table that you can build with hand tools. It's stout and expensive looking, but the materials cost me only $18.

One of its features is the double-life top. The glass bricks are tough, but even if one is broken, you can just turn it over and you have another perfect top. Then, too, spilled liquids can't hurt the glass.

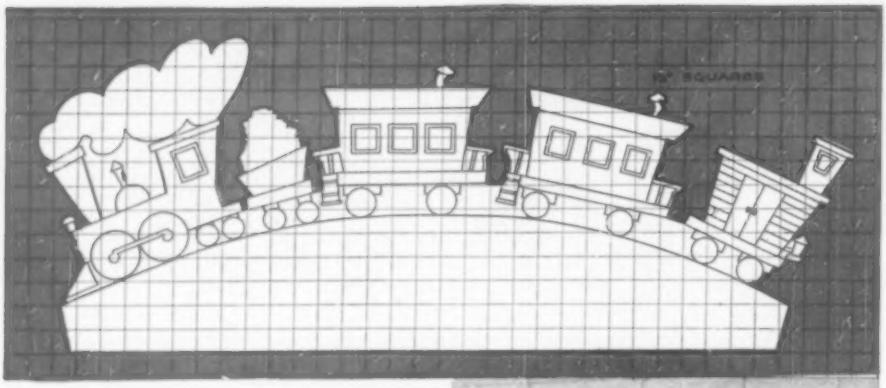
Construction is fairly simple. The only joints that might be considered at all difficult are the four corner dovetails, but their large size makes them relatively easy. These can be cut with a saw, chisel, and mallet. Take care in cutting them. They must fit tightly and be absolutely square. Otherwise, the frame won't be square and the glass bricks won't fit correctly. If you've never made a dovetail before, see PS, April '44, p. 151.

The top frame is of ¾″ oak pieces, mitered at the corners like a picture frame. The plywood gussets are screwed and glued to the underside of the corners as shown. This frame must measure exactly 23⅝″ square inside. The glass bricks are 11⅞″ square, or 23½″ square with four of them laid together. The extra ⅛″ allows room for thin oak strips to be wedged between the bricks to hold them flush against the side of the frame.

Glue and screws hold the top cleats to the underside of the top frame. Then the top frame can be glued to the side frame. Clamp the pieces until the glue sets. The bottom cleats are screwed in place so the distance from their upper sides to the top of the frame is exactly 3⅝″. That's the thickness of the bricks and it's important that the tops of the bricks be flush with the frame.

The legs measure ¾″ by 11⅛″ by 31″. They're slotted for half their width at the center so they slide into each other at right angles. Dimensions for the bottoms of the legs are shown in the drawing.

All corners were rounded off with a file and sandpaper. Then all surfaces were thoroughly smoothed. Fit the bricks in the frame with the ribs of each pair running at right angles to each other. The thin strips are then inserted.—*R. Cueva, Heyburn, Id.*



Give Your Child A Towel Rack

DOES your youngster hang his towel on the bathroom floor? This little trainer will make it easy for him to remember where the towel belongs.

Draw a grid of ½" squares and copy off the pattern above line for line. Next trace the outlines onto a ¾" by 7" by 17" piece of plywood or hard composition board. Saw the outline, file all edges, and smooth any remaining roughness with sandpaper.

The towel bar is made from two wooden end blocks and a length of ¾" dowel. Inner faces of the blocks are spaced approximately 13" apart, and the dowel is 14" long.

Drill a ¾" blind hole in each block spaced so that there will be about 1½" clearance between the dowel and the backpiece. Screw the blocks to the base from behind.

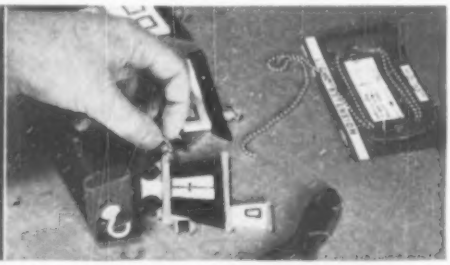
An enamel undercoat—Firzite® is fine on fir plywood—prepares the surface for the many-colored enamels that finish the unit.

Suction cups or screws hold rack to wall.

Flat white makes satisfactory smoke; the other colors are up to you but they should be bright and varied. It's a good idea to let one enamel dry thoroughly before applying the next one alongside. Otherwise the colors may run together.

Turn a colored cuphook into one of the side blocks so a child can hang his washcloth with the towel. The unit can easily be screwed to a wood or plaster surface. To hang it on tile, use suction cups or a masonry drill and screw anchors. Be sure to place it low enough for your youngster to reach.

Final shape of the cutout. Note that the wheels and the spaces between them are left solid. Cutting them out might weaken the piece.



Cars are linked together by small pieces of ball chain of the kind used for lamp pulls. Drill ⅛" holes in the car ends for the chain.

Reminders for the Man Who Cares for a House

January

- Check snow and ice in gutters and on roof. Remove before load gets dangerously heavy.
- Cut poles and posts for fences or rustic furniture. At this time of year, seasoning is gentle and doesn't cause checking as much as summer drying does.
- Fix up rumpus room. Build closets and attic rooms.
- Check appliance wiring. Replace worn cords.
- Repair or replace broken locks.
- Drain and refill steam boiler.

February

- When necessary, clean snow from cellar windows. Thawing may cause leakage around sash.
- Repair and paint screens, lawn and porch furniture, and other items for use next summer.
- Check faucets for drip. Replace washers where needed. Clean plumbing drains.
- Sharpen and grease lawn mower. Check garden tools for needed repairs.
- Build storage room in basement for garden vegetables. Prefabricate hot beds and cold frames.

March

- Thaws may show up roof damage. Use plastic roof compound to repair breaks in chimney or flashings.
- Clean outdoor drains, culverts, and gutters.
- Damp-proof basement walls. This is usually a wet month. Basement walls may show up moisture not noticeable at other seasons.
- Pick up branches and twigs broken off during winter. Cut big ones to fireplace length.
- Drain and refill hot-water heater.

April

- Take down storm sash and put up screens.
- Inspect tree limbs for possible hazard over walks, drives, and utility lines.
- Shut down heating plant. Remove smoke pipes. Clean and inspect them for rust. Clean boiler.
- Repair and paint flower boxes and trellises.
- Prefabricate and paint fences for fair-weather installation.
- Build storage shelves for canned fruit.

May

- Do outside painting before summer insects arrive.
- Open attic windows or louvers and basement windows for summer ventilation.
- Fill in sunken and washed-out spots and roll lawn.
- Replace rotted fence posts. Repair gates and locks.
- Inspect clothesline; replace if weakened. Ditto clothespin box. Check radio and TV antennas.
- Stow auto chains.

June

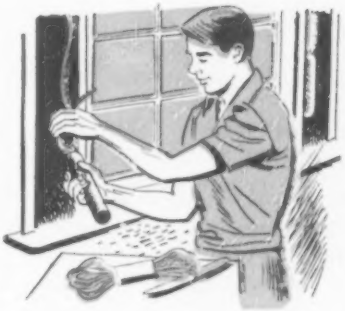
- Check fire extinguishers.
- Clean up rubbish and tidy wood piles. Repair hose and lawn sprinklers.
- Build or repair compost enclosure and strawberry walls.
- Make vacation equipment. Check fishing tackle.
- Check outside water and electrical outlets. Add more if necessary.
- Inspect supports under porch and outside stairs for rot.

Reminders for the Man Who Cares for a House

July

- Check belts on refrigerators and freezers. Oil motors. Have serviceman replenish gas supply if you find loose bolts around the compressor gaskets.
- Inspect interior to see if painting or papering is needed. Lay new floor covering if necessary.
- Install sump pump and new cellar drains if needed. This is a good time for this kind of work. Cellar is usually dry at this season.
- Insulate cold-water pipes to prevent condensation drip.

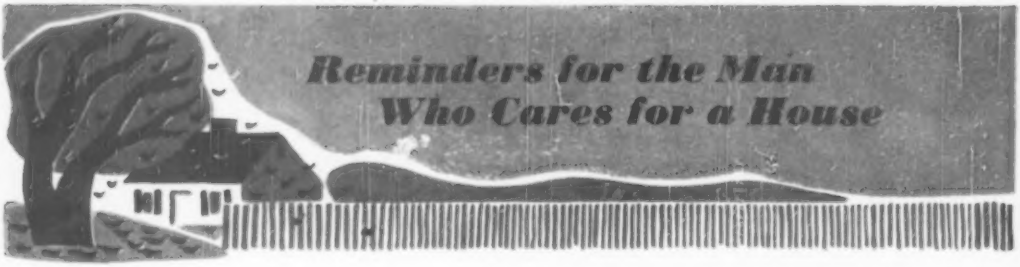
August



- Replace frayed sash cords.
- Clean radiator valves. Replace defective parts.
- Put fruit cellar in order for canning season.
- Inspect all flashings. Apply roofing compound. Check gutters. Make needed repairs.
- Clean chimney flues from top to bottom. Check condition of andirons. Replace dogs if burned out. Polish brass and relacquer.
- Tighten rattling windows.

September

- Prune shade trees and seed lawn. Get leaf cart in shape.
- Repair coal bin and put in winter supply. Or have oil tank filled. Lay in supply of kindling. Check coal scoop, clinker tongs, poker, and ash-removal container. If gas is used, have company inspect unit.
- Oil and store electric fans.
- Drain and refill water heater.
- Do outside masonry jobs.

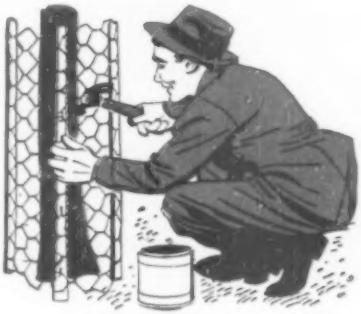


Reminders for the Man Who Cares for a House

October

- Take down screens and put up storm sash.
- Clean drains, gutters, and downspouts. Inspect roof.
- Condition furnace and install new filters if needed.
- Shut off and drain all outside water outlets that are susceptible to freezing.
- Inspect tree limbs for possible hazard over walks and utility lines. Ice storms cause branches to sag or break.
- Check weatherstripping.

November



- Drain steam or hot-water heating system and refill with fresh water.
- Store garden tools. Oil and store lawnmower.
- Check yard lights. Replace old bulbs.
- Place wire netting around trunks of fruit trees to protect them from rodents.
- Drain pools. Fill with straw and cover with boards.
- Calk cracks in basement or foundation.
- Lay in supply of chemical snow remover.

December

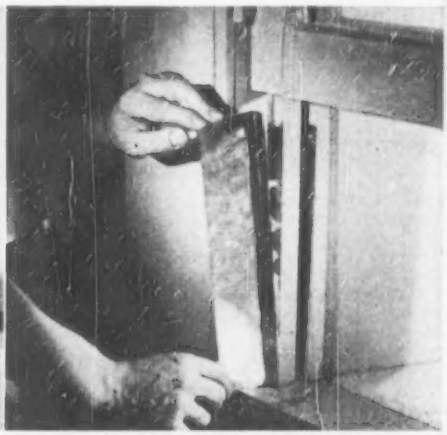
- Plan Christmas wiring if grounds are to be lighted.
- Inspect Christmas-tree wiring, repairing and replacing parts and bulbs where needed.
- Make sure fire extinguisher is in good order.
- Overhaul washing machine, sweeper, and iron.
- Plan for improved toy-train layout.
- Inspect basement stairs and banisters for sturdiness. Make repairs and paint.
- Merry Christmas and a Happy New Year.

Inside stop—vertical rail that guides window on room side of casing—is marked for cutting by template included in kit. Top hole for one of two thumbscrews, also supplied, is centered and drilled 1" below this line. Lower hole is drilled midway between top hole and sill.

Washing Windows Inside Out

TURNING a window inside out to clean the outside inside may sound like double talk. But that's exactly what you can do with this kit invented by Fred Roth, of Brooklyn, N. Y. The bottom halves of the inside stop and parting strip on each side of the casing are cut out, joined by metal strips, and screwed back in place. When these are removed, either sash can be lowered and swung up inside the room.

Stop is then sawed along line and the lower half removed. Wood screws with tapped heads for thumbscrews are inserted in holes in casing.

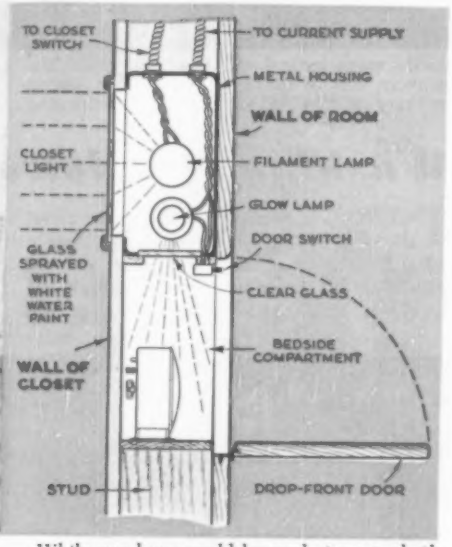


Metal strip from kit is held against parting strip—middle guide rail—and nail holes marked. Parting strip is cut at bottom of raised sash.

Metal plate is nailed to cut section of parting strip and to inside stop. Hole is drilled through metal for lower thumb nut. At left is completed unit. When it's removed from frame by loosening thumb nuts, either sash can be swung inward and locked upright for cleaning the outside.

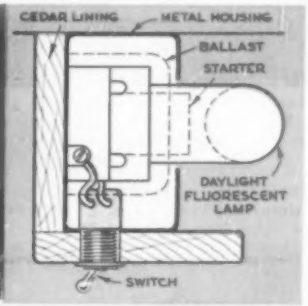
These Lamps Are Never In Your Way

By John Modroch



When a closet and bed share the same wall, this type of combination fixture can light up two dark spots with one bulb. To install a unit of this kind, it is necessary to break into the wall. Most of the damage, however, can be limited to the closet side; so if a seam shows in the patched plaster, it won't make much difference.

While one lamp could be made to serve both functions, an additional glow lamp controlled from the bed side is a worthwhile part of the installation. Its dim rays are just right for illuminating a clock face at night when all other lights are off, and, if you wish, you can leave it burning as a night light.

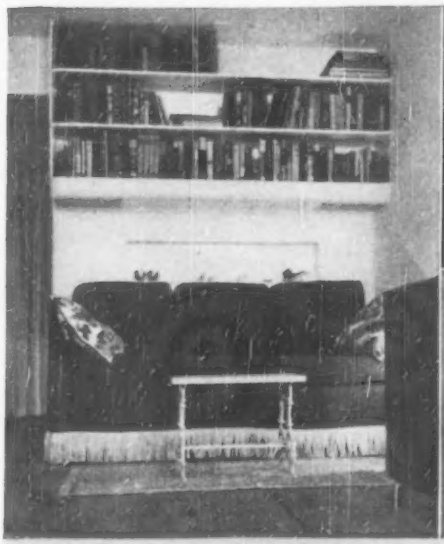


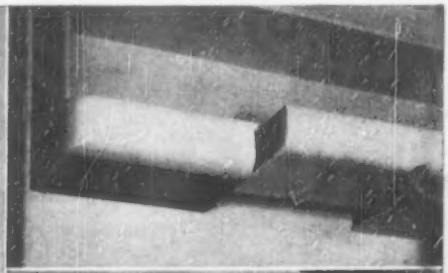
A ceiling baffle running across the front of a closet opening directs light into the storage area instead of into your eyes. And a daylight fluorescent lamp behind the concealing strip brings out the true colors of the clothing hanging on the rack, thus making it easier to select matching garments.

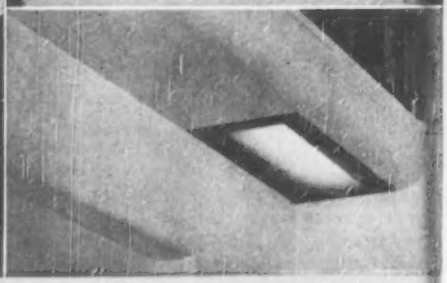
In this installation a toggle switch brought through the lower mounting strip turns the light on and off. In some cases, a "normally on" push-type switch can be conveniently recessed in the door frame in such a way that opening the door releases the switch button and turns the light on.

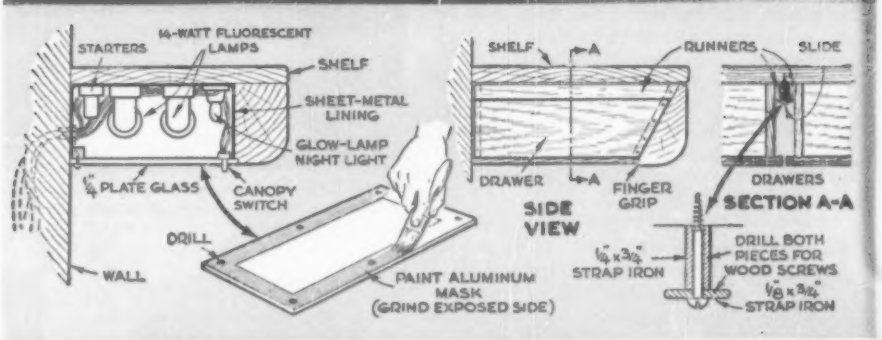
THE best light is the light that shines where you want it. Decorative lamps can provide it in many places, but in some spots even the best lamps either are in the way or fail to provide the proper kind of illumination.

There you are likely to find a built-in light highly desirable. Such lights leave the working area free of fixtures, and for simple good looks they can compete with the best of modern lighting arrangements. Here are three suggestions for your special needs.









Shelving that overhangs a divan is a natural place for built-in reading lights. Here, one is used at each end of the shelf, and a row of matching drawers has been built in between them. These shelves are 10" deep, which is ample for two 14-watt fluorescents and a glow lamp. For 8" shelves, it may be necessary to compress the fixtures slightly. Making them a trifle longer would permit mounting of the starter and glow lamp alongside the fluorescents instead of in front and back.

Ballasts for these lights are remotely housed in a perforated metal box in the basement. There the heat they generate is readily dissipated without danger to the ballasts or cabinetwork. This arrangement doesn't require ventilation of the cabinets, and the reading lights are silent as well, since it is ballasts that cause hum.

Cabinets are lensed with ¼" plate glass, which is drilled as shown for the mounting screws and switches. (For glass-drilling methods see PS, March '49, p. 239.) To frost the exposed side of the glass, make a paste of medium abrasive powder and water and rub it over the surface with the bottom of a flat bottle.

Painting an aluminum mask around the edge of the glass makes the mounting screws less noticeable and adds a neat finishing touch.

Use Your Wood Scraps for This Tray

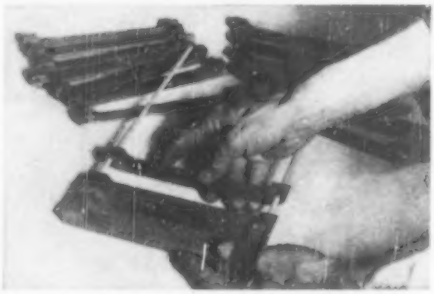
Tongue and groove these pieces, drill holes for the dowels, and bandsaw the strips.

DO YOU have any fine hardwood scraps that are too good to waste and too small to use? You can put them to work by making this expensive-looking tray. It's built up in sections from small pieces. It isn't even necessary for all the wood to be of the same kind, because you can get many interesting arrangements by putting dissimilar pieces side by side. The tray may be almost any size, within the limits of the stock you have.

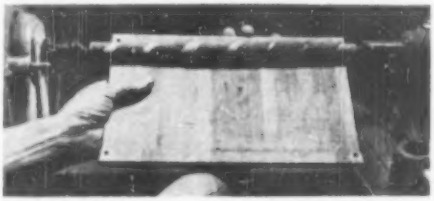
Rip all pieces to uniform width and tongue and groove all except the handles and endpieces. Bore ¼" holes for the stiffening dowels; the endpieces have blind holes for both these dowels and, at right angles, for dowels that hold the handles.

Bandsaw all pieces to the shape shown in the drawing and assemble the tray base with glue. When it has set, sand the tray thoroughly. A good job can be done by chucking a sanding stick in the lathe as shown in one photo.

Attach the handles with dowels and glue and true the outside surfaces of the tray and handles. Apply a coat of thinned shellac, rub it down well, and finish with a coat of waterproof varnish.—*B. Nielsen, Aurora, Neb.*

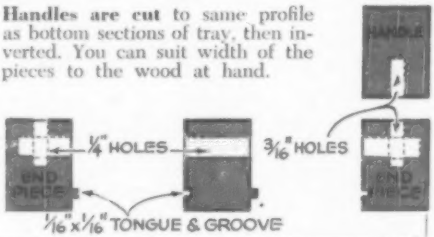


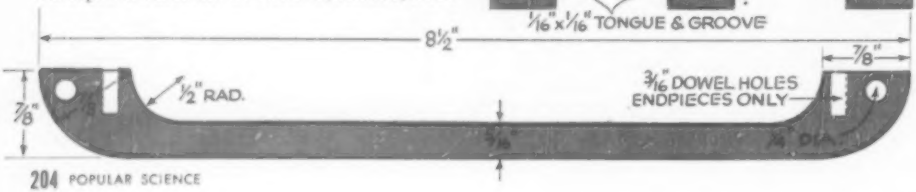
Assemble the sections with glue. All base strips except the ends are bored all the way through.



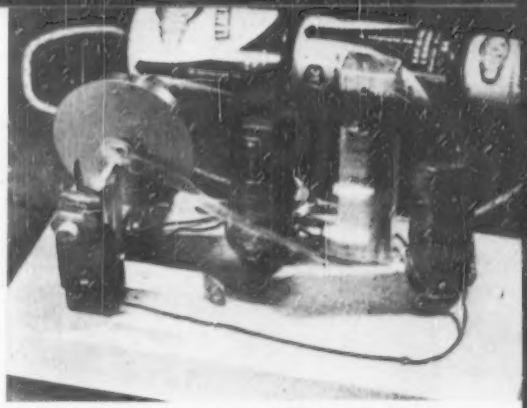
Sand the base thoroughly before putting on the handles. A sanding stick in a lathe is shown.

Handles are cut to same profile as bottom sections of tray, then inverted. You can suit width of the pieces to the wood at hand.





Magnetic Engine Whizzes on Dry Cells



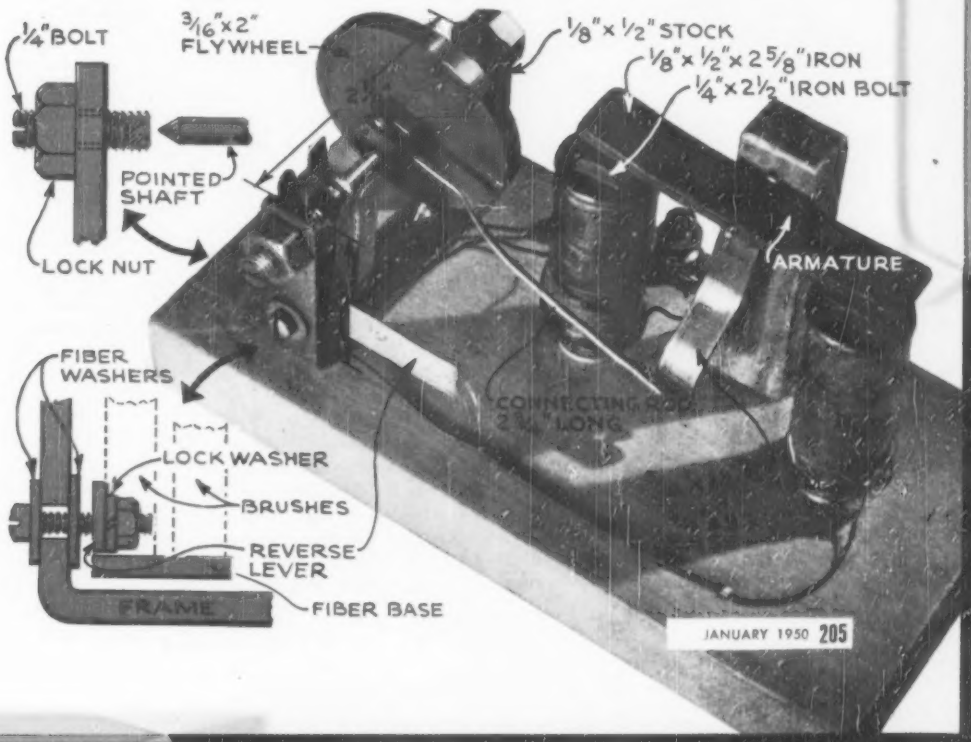
How it works: view in motion shows ends of horizontal rocking armature pulled alternately by electromagnets, oscillating vertical arm (center, blurred by motion) that moves the connecting rod that spins crankshaft (left).

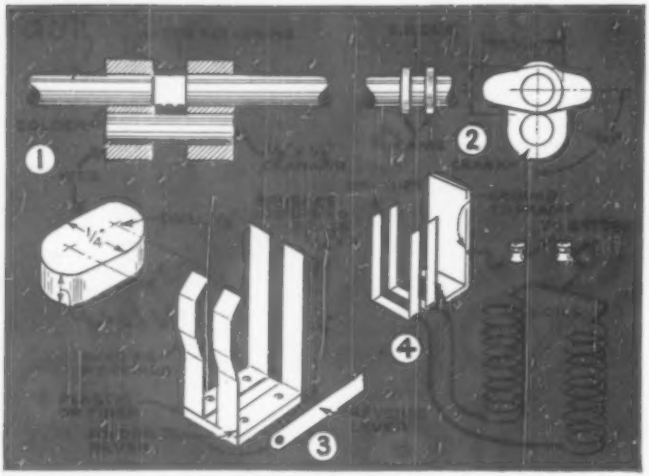
By Walter E. Burton

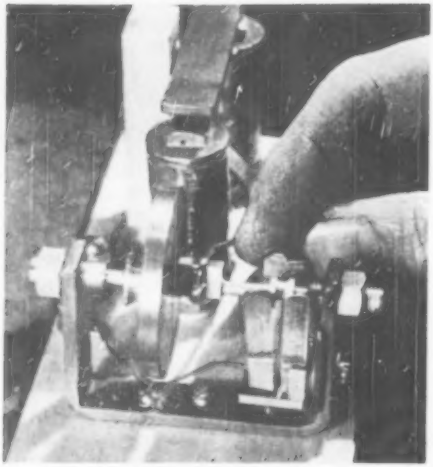
THREE flashlight batteries will spin this "two-cylinder" reversible engine at a merry clip. Fed 10 or 12 volts, its unusual "rocking-beam" action will develop enough power to drive toys or window displays.

The crankshaft is a brass rod, pointed at both ends, that runs in pivot bearings. You can turn the shaft ends in a lathe or point them by filing one end while rotating the shaft in a drill chuck. To form the dimples on the ends of the bearing screws, use an old

Magnets are wound on ¼" bolts. Two ¾" washers are separated 1⅜" and the space between is wound full of No. 22 insulated wire.







Flywheel shaft close-up shows crank, cams and pivots. Note pulley to the left of flywheel; it's used for power take-off for toys.

or broken drill reground to a suitable angle. These screws are supported in a U-shaped iron yoke; if you don't have suitable stock, use dime-store angle irons. Drill and tap the sides of the yoke for the screws, and secure them with lock nuts.

Figure 1 gives details of the crank. You can use two pieces of brass bar stock for the webs. Drill ⅜" holes side by side through both at once. Slip them over the shaft and crankpin, solder in place, and saw out the portion of the shaft that remains between the webs.

Any small flywheel can be used. Place it near one end of the crankshaft. Near the other end, solder on a pair of cam-like pieces for the make-and-break contact with the brushes that send juice alternately to the two electromagnets. Shape these pieces as shown in Fig. 2, and space them about ⅜" apart, turned so that the longer portions project at right angles to the crank.

For the brush assembly (Fig. 3), you'll need a small piece of insulating material such as ⅛" plastic or fiber, some springy brass, and a stiffer metal strip for the reverse lever. Solder this across the legs of one of the brushes. Rivet the brushes to the insulating platform.

The lower inset in the photo on the previous page shows how the brush assembly is mounted. Note that the bolt passes through an oversize hole in the yoke and is further insulated by fiber washers on both sides.

The "cylinders"—the electromagnets—you can swipe from a doorbell or make yourself by winding wire on a bolt. To mount home-wound magnets, run the threaded bolt ends into holes in the wooden base.

Make the armature by drilling a pivot hole edgewise through a strip of soft iron. Solder a strip of stiff brass to the lower face of the iron for the arm. Near the lower end of this, drill a hole for the stiff wire connecting rod. Attach the assembly to a wooden upright by a free-fitting nail through the pivot hole.

The armature ends should come close to the magnet poles without actually touching. If necessary, bend the armature ends upward to make them approach the poles squarely. When the crank is in a vertical position, the armature ends should be equally distant from the poles.

If oiling the bearings prevents current from getting from the frame to the shaft, arrange an additional brush of springy brass so that it presses lightly against the shaft.

Adjust the U-shaped brushes so that each one touches a contact cam as the crank moves past dead center. A cam contact area ⅜" long is about right. END

Scrap Linoleum Covers Closet Floor at Low Cost

SMALL pieces of linoleum left over from a job can be used crazy-quilt fashion for covering closet floors, shelves, basement steps, and other areas where the pattern and number of seams aren't important. Mottled linoleum is particularly good for such jobs because there's no pattern to match up.

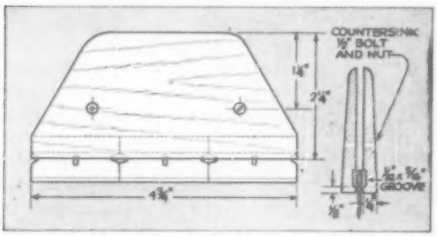
Cut the largest pieces to fit in front of doorways or wherever the traffic will be heaviest. The trick of getting edges to fit snugly isn't hard. Basic steps are shown in these photos.

1 **After one piece is in place,** slide another under its edge. Arrange the second piece to cover a bare area. Fasten the pieces to the floor with brads driven part way.

2 **Use a linoleum knife** or other sharp tool and run the blade tip along the edge of the upper piece. Accuracy is more important than completing the cut on the first pass.

3 **Remove the trimmed part** from under the top piece (after pulling out the brads) and cement the newly cut section. For a cement spreader, file notches in piece of aluminum.

4 **After cementing, roll the piece** firmly to assure good adhesion. Corners and edges that show a tendency to rise should be weighted overnight with some flat, heavy objects.



Tool Speeds Paint Cleaning

YOU can scrape paint off a window or tile faster with three razor blades than you can with one. The triple holder at the left is easy to make from wood or plastic. The dimensions shown are for use with standard single-edge blades. For safety, slit a piece of garden hose and slip it over the tool when not in use.—*George Muir, Los Angeles.*

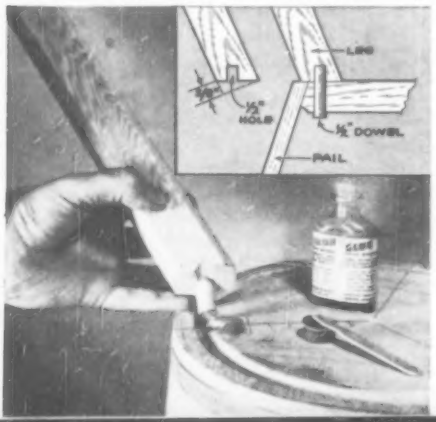
Pail Is Jumbo Sewing Basket

STYLED after a Pennsylvania Dutch design, this outsize sewing tub can be built with only a couple of hand tools. The tub started as an ordinary unpainted wooden pail from a hardware store. The lid is a chopping block with two wooden drawer knobs screwed to the top. The authentic designs are decals, easily applied.

The first step is to take the handle off the wooden pail. Then rub down any rough spots with a file or sandpaper. Saw the 12″ legs from 1⅝″ stock. I put a ¼″ bevel on each corner of the legs just to dress them up. Attaching the legs is shown below.

Finish the outside any way you like. The inside is fabric lined. Replace the lining with a metal pail, and the tub can hold plants.—*Arthur Miller, The Bronx, N. Y.*

Each leg is cut diagonally ⅝″ from one end. Then matching ½″ holes are drilled in bottom and legs. Use plenty of glue on dowel and leg.



Tool Wrestles Roast for You

IF CARVING roasts or birds throws you for a loss, here's the tool for you. The scissors-like action of Roast Ressler® securely clamps the meat while you slice it. It's made of brightly buffed solid aluminum and is priced at about $5 by K. G. Niblack, Buffalo, N. Y. The tool is also useful in removing hot roasts or fowls from the oven. It's adjustable to three positions to handle small rolled roasts as well as large birds.

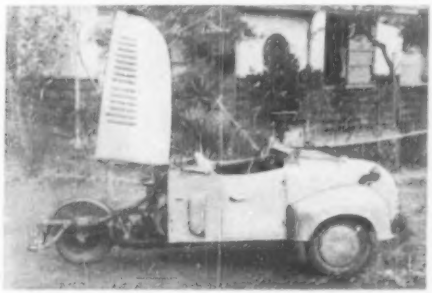
Flint Lights Lantern

MOUNTED permanently in the lighting hole of a gasoline lantern, this lighter throws a fat spark to light the gas when the outside knob is spun. It fits any gas or acetylene lantern and uses ordinary cigarette-lighter flints, easily replaced. Built of welded tubing with oversize spring and threads, the lighter is especially useful in windy and rainy weather. The lighter unit, ready to install, is sold for $1 by the Gates Sales Company, of Cleveland, Ohio.

Cars Built By PS Readers

Garage, Too. Young Tommy Marotta, of Boonton, N. J., has not only a speedy little roadster (above), but a miniature garage (right) in which to keep it. His father, Patrick, built both. The 174-lb. car is powered by a ¾-hp. engine.

This One's for Grownups. Although small, the teardrop car (right) built by Bill Roush, of Montgomery, Ala., carries two adults and a child. It's powered by a 6-hp. Briggs and Stratton engine, does about 40 m.p.h., and gives around 50 miles per gallon. Roush figures he has about $300 invested in the little car.

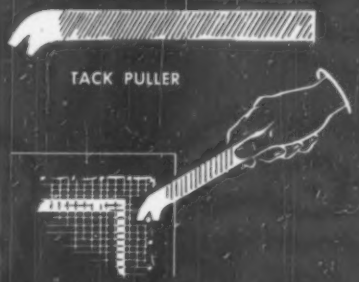


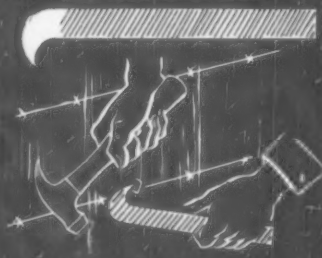
Jap Scrap Put to Use. Aluminum from a Japanese aircraft plant was used for the body of this three-wheeler, and the pipe frame came from the same source. The car has a 6-hp. air-cooled gas engine in the rear and a three-speed transmission. Built by T. Shimizu, with the U. S. Army in the Pacific, it will do over 40 m.p.h.

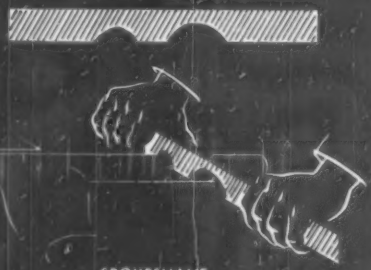
Tuning Up a One-Lunger. Eight-year-old Joe Fisher is the envy of every other kid in his Cleveland neighborhood when he drives around in the midget racing car his father built at a cost of about $100. It has forward and reverse gear and hydraulic brakes. Its one-cylinder engine gets 70 miles on a gallon.

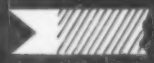
Use an Old File

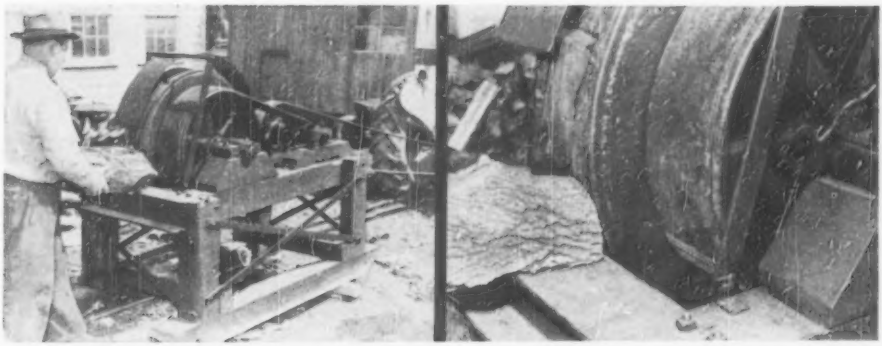
The high-quality steel in good files makes them too valuable to throw away when they've reached the end of their useful life. Here are some things you can do with them. When you have to bend the stock or drill a hole in it, heat it to a cherry red and allow to cool slowly. Reharden by heating the steel again and plunging it into water. If you want a smooth surface, the teeth can be ground off.









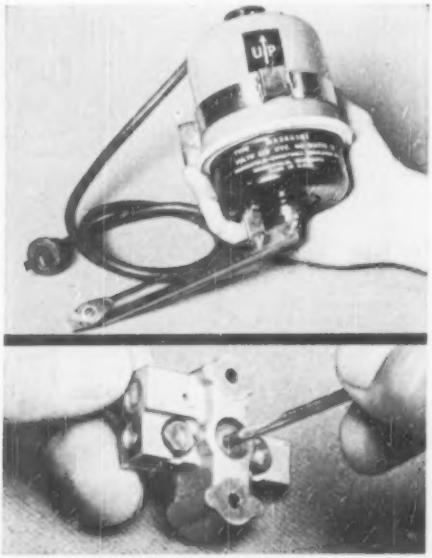


Powered Wedge Splits Three Cords an Hour

To SPEED up his wood-splitting chores, Paul W. Walk, of Kundletown, Pa., built a fast-acting, powerful wedge by mounting an old solid-tire truck wheel on a reinforced oak frame. The rubber was removed from the wheel and a seven-pound steel wedge welded and bolted on the rim. A one-inch steel disk was also welded to the wheel to add weight. The power take-off of a tractor drives the splitter.

Clip Dispenses Cartridges

FASTER, easier rifle loading is made possible by a molded-plastic dispenser manufactured by Moore-Warden Products, Wichita, Kans. The loader, which holds a full box of short, long, or long-rifle .22-cal. cartridges, clips to the belt. Slipping one or more shells out of the holder is a simple one-hand operation. The dispenser is available in clear or colored plastic for 79 cents.



Hydraulic Unit Works Damper

YOU can make your coal furnace partly automatic with this Electric Janitor®, made by Minneapolis-Honeywell to sell for about $23. It's an electro-hydraulic unit that turns the damper on and off. When heat is needed, a thermostat switch turns on a small motor that actuates the tiny hydraulic pump shown in the lower photo. The pump operates a spring-loaded lever linked to the damper.

Radio Is Worn on Wrist

Two tiny new Dick Tracy types of personal radio—Tiny Tooners®—are made by the Acousticraft Corp., of Chicago. The model shown above has a tuner that straps to the wrist and a separate case for battery and receiver. A second style incorporates tuner, receiver, and batteries in one pocket-size case. The sets use two tubes. About $11.

Vibrator Agitates Developer

If you own a small electric massager, you can put it to work in your darkroom to save developing time and give you better negatives. Simply strap it to a developing tank and let it jiggle while the film is being processed. Suspend the tank and vibrator by a heavy rubber band or coil spring for best results.—*C. W. Harris, San Bernardino, Calif.*

Prefab Aluminum Window

A complete prefabricated window package, ready for the builder to install, is being made by Fleet of America, Inc., of Buffalo, N. Y. Included are frames, double-hung sash, storm sash, and screen, all precision made from extruded aluminum. All sash sections snap out for cleaning. Photo below shows frame used as a masonry form.

Pitcher Keeps Drinks Cool

Drinks can be kept cold without being diluted by melting ice in a pitcher offered by Eunice Novelties, of New York City. It has an aluminum cylinder suspended from the cover. Ice cubes are put inside the cylinder, where they can do their cooling job without watering the drink. All parts can be separated for easy cleaning. Retail price is $10.

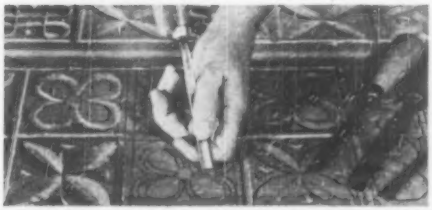
You, Too, Can Chisel

By Doris Aller

Inexpensive tools and elbow grease are all you need to turn out rich carvings like these. For detailed steps, see below.

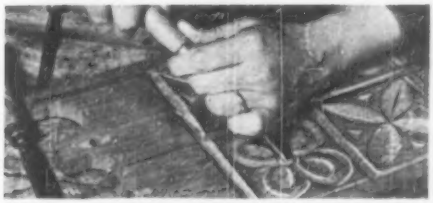
ANYONE who can slice a roast can carve wood.

It's that easy. Take the cabinet pictured below. Uncarved, it'd be just another spice cupboard. But add the carving and you've got a piece of furniture that looks



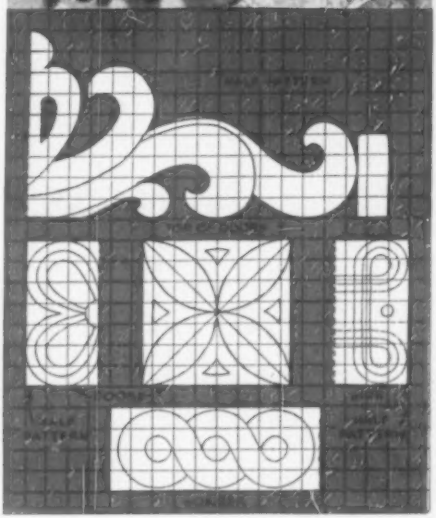
Pencil design on wood. First step is to make depth cut along the center line of the design.

Slanting cuts from each side meet the depth cut to remove the wood and leave a smooth trough.



The button in the center of the design is made with cuts of a medium gouge held bevel side up.

Cuts of V chisel are used to clean out wood and sharpen up bottom of boat-shaped section.

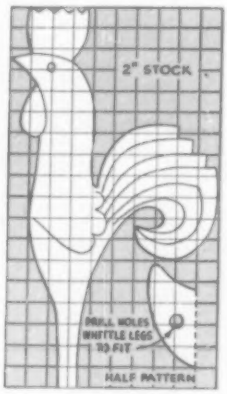


like the fine work of an old-time cabinetmaker.

To set yourself up as a carver, you need only a few simple tools and easy designs like these. The decoration on the cupboard was cut into the wood, leaving the background raised. That's incised carving. On the jewel box and wall boxes for dried herbs, the background was cut away, leaving the design raised. That's relief carving.

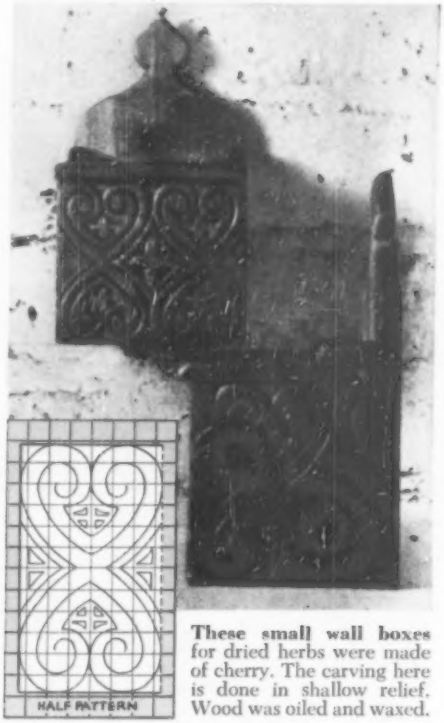
You can get along with as few as four tools: a straight chisel, two curved gouges, and a V tool. Tools must be kept sharp both on the beveled and inner edges. A small slip stone suited to the curvature of your smallest gouges is necessary.

Cutting is done by removing small slices and chips with the grain. Cutting across the grain is useful in removing large amounts of waste wood. Clamp the work to a bench and hold the tool with both hands. Push the tool forward with one hand. Guide and hold it with the other. Avoid heavy, thick finishes. Rubbing with boiled linseed oil and finishing off with wax is usually sufficient. END



Rooster for table decoration. Profile was cut out on bandsaw from 2" hardwood. Files and sandpaper were used to round out the figure.

A strip of simple carving in shallow relief decorates the top of this jewel box, which is made of maple. All designs are shown on the squares.

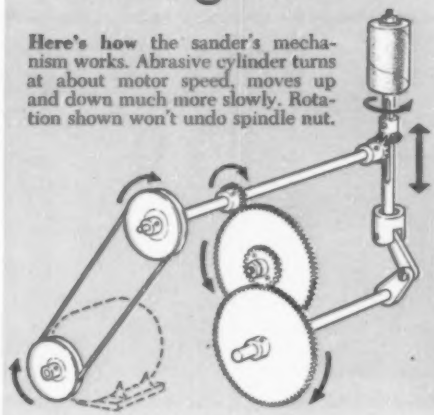


These small wall boxes for dried herbs were made of cherry. The carving here is done in shallow relief. Wood was oiled and waxed.

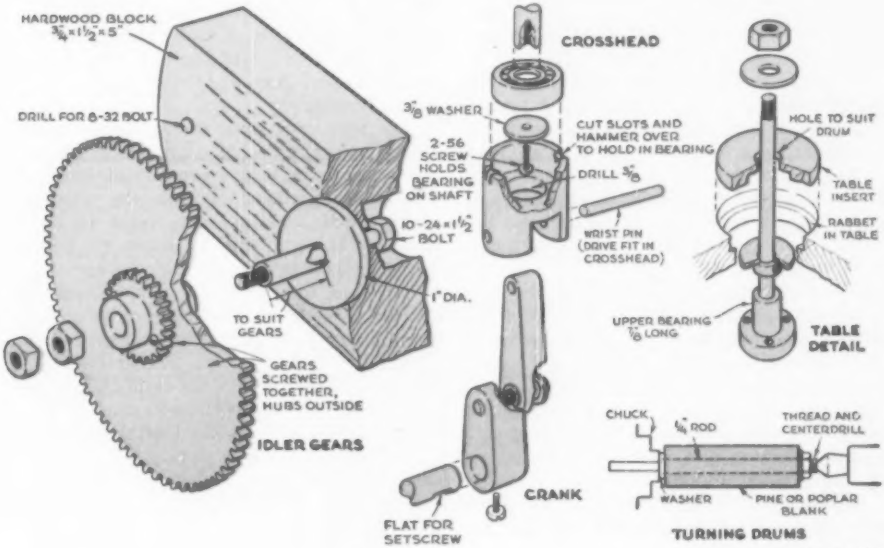
Here are the six most useful wood-carving tools. The beginner can start with four, counting from the left. End shapes are shown under each tool.

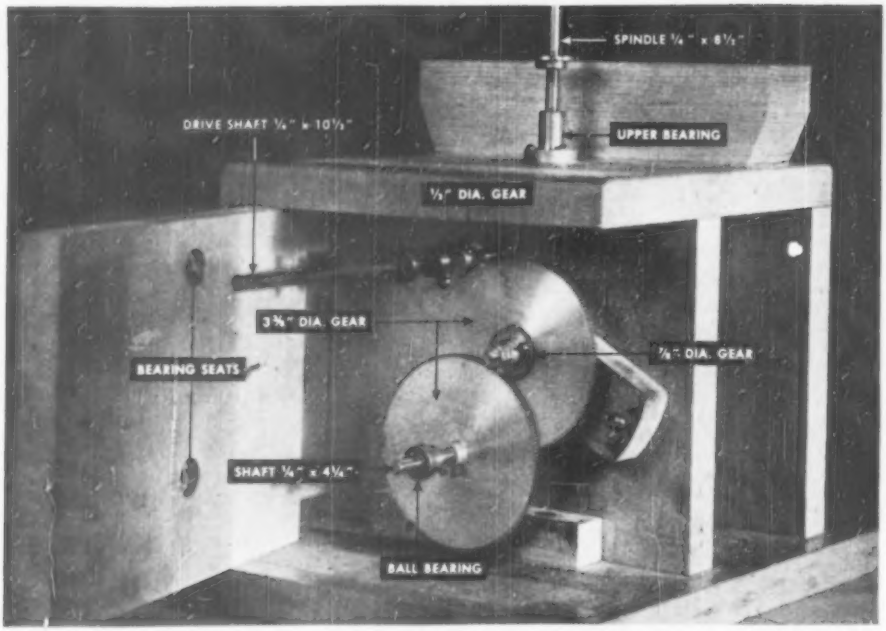
Half-Pint Sander Does Big Jobs

Here's how the sander's mechanism works. Abrasive cylinder turns at about motor speed, moves up and down much more slowly. Rotation shown won't undo spindle nut.



UNTIL you've used an oscillating sander, you won't realize how good drum sanding can be. With this rig, the drum not only rotates but moves up and down across the work. The result is that it forms no ridge marks and produces a much smoother finish. The abrasive sleeves last longer than on ordinary drum-sanding setups because the ➧





With one side of box partially removed, this photo shows gear setup and ball bearings.

wear is evenly distributed. With small, homemade drums, you can smooth sharp curves in intricate jigsaw work. With larger drums, you can quickly sand to shape and smooth up furniture legs, bookcase sides, and similar gradually curved pieces. If you make a fence notched for the drum and clamp it to the table, you can use the sander to dress the edges of straight stock.

Materials needed include drill rod, small ball bearings, and light-duty gears. I got my gears at a war-surplus store. The sander can be driven by a ⅛-hp. motor. If you don't have a spare motor but do have a lathe, build the sander so that the drive shaft is at lathe center height. You can then clamp the sander on the bed, chuck the shaft, and drive it with the lathe motor.

When shopping for gears, try to get sizes as near as possible to those shown in the photo. These will give you the proper ratio of oscillation to spindle speed.

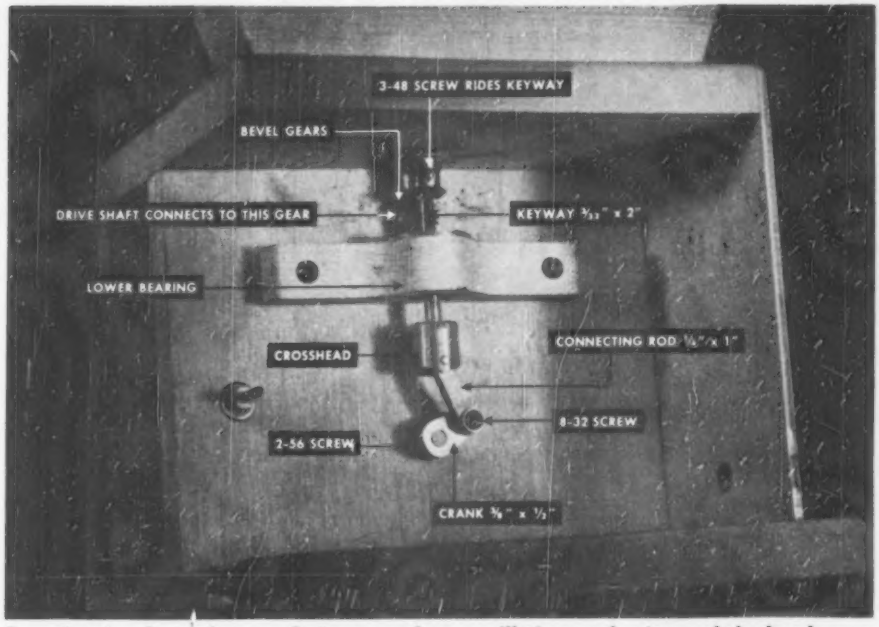
The box that houses the mechanism was assembled with screwed cleats. That made it easy to remove one section of the box at a time for drilling and fitting without taking apart the whole sander.

A piece of ¾" brass rod was turned down to make the crosshead. It has a ⅜" slot cut in it to clear the connecting rod. The rod was sawed from ¼" flat brass and the crank from ⅜" flat brass.

The crosshead links the crank to the vertical shaft. Since the shaft has to turn, it's fitted in the crosshead in a ball bearing. Bore the crosshead to receive the outer bearing race snugly. A screw holds the bearing on the shaft. Slot the top edge of the crosshead and peen it over to hold the top of the bearing.

The idler gear turns on a stationary stud that's bolted to a wooden block on the center partition. Where you put this block on the center partition controls the way the gears mesh, and you may want to make oversize holes in the partition to permit slight adjustments of the idler position.

I turned the drums on a lathe, making them a close fit for the sleeves with a slight taper toward the top. The sleeves for the ¾" and 1½" drums are available in 10" lengths. These can be cut to fit the drums. For the ⅜" and ½" drums, you can buy little sleeves about ½" long—the kind that are used on hand grinders. Five of these are mounted on the drum. The sleeves are held tightly on the drums by tightening the spindle nut on top of the washer.



Opposite view from photo on facing page shows oscillating mechanism and the bevel gears.

Make a set of inserts for the counterbored hole in the table top. Each insert has a hole for a particular drum. By using the right insert, you can work right up to the face of the drum, even with very small work. Keep the through hole on the inserts as small as possible to minimize the amount of grit and dust that will get inside.

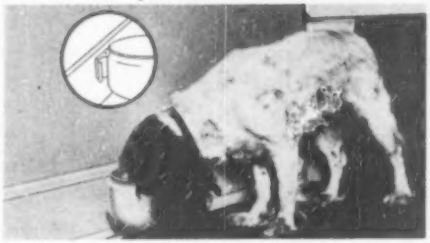
If there's any tendency for the sleeves to pull loose on the downward stroke, you can cut the sleeves 1/32" longer and fit a washer under the nut to clamp the sleeve down.

Before closing up the box, I packed the ball bearings and coated the gears and all moving parts with cup grease. I think it's a good idea to add powdered graphite to the grease, especially on parts that turn fast and hence might sling plain grease.

When the sander is used on my lathe, I set the lathe to run at second speed. This turns the sleeve about 1,300 r.p.m. and about 50 oscillations per minute. If the sander is belted directly to a 1,750-r.p.m. motor, a 2" pulley on it driving a 3" pulley on the shaft delivers about the same speed.

Give the box a good sanding and several coats of shellac well rubbed with steel wool. Or you can paint it if you prefer. I wouldn't paint the table top, however. I give mine a coat of wax from time to time, which keeps it smooth and good to work on.—*Herbert Pfister, The Bronx, N. Y.*

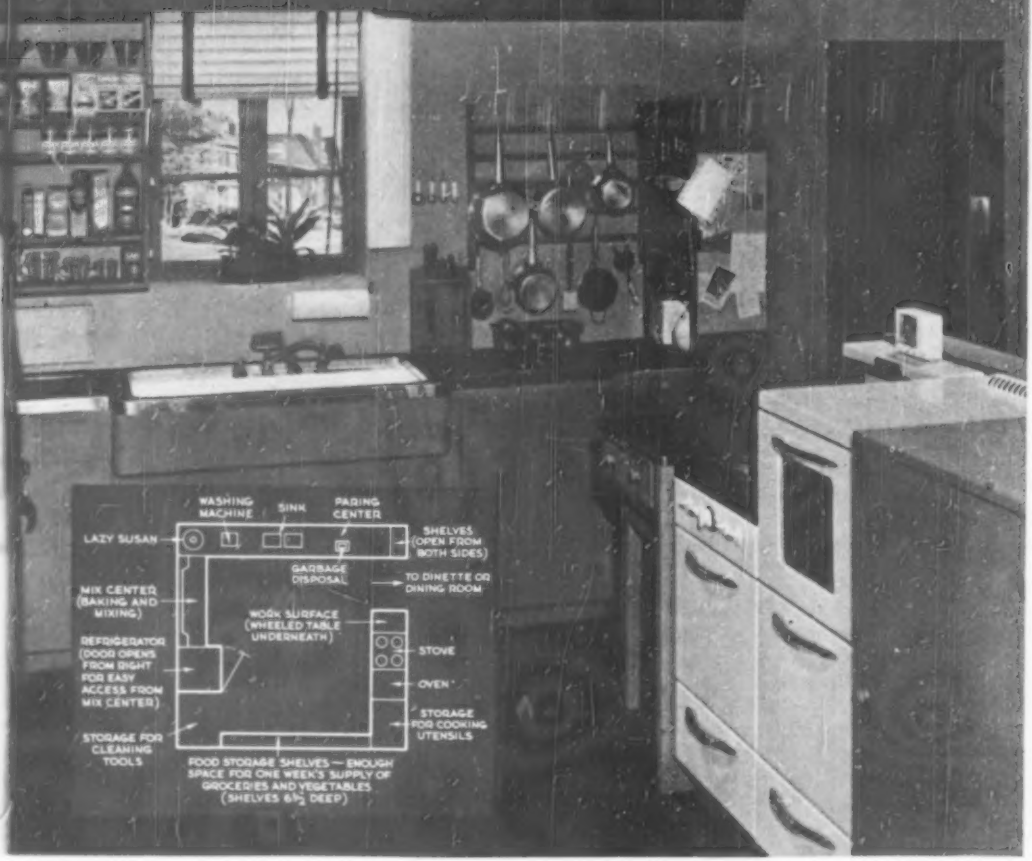
Dog's Dish Fits on Wall, Can't Spill



EVEN if Rover plops his big feet into this 36-oz. spun-aluminum bowl, it can't upset when it's fitted into the wall bracket. It's priced at $2.75 by Westberg & Johnson, Bridgeport, Conn. Extra brackets—so the same bowl can be used in various spots—cost 50 cents each. The bracket is attached at any convenient height by three screws. A special fitting to attach the bowl to a wire fence is available.

Labor-Saving Kitchen Designed By Doctors

...You Can Build One Like It



By George H. Waltz, Jr.

HOW much work is it for your wife to prepare your breakfast? *If your kitchen is as inefficiently arranged as most, she probably makes at least twice as many motions as necessary.* And, since that proportion holds for most of her daily kitchen operations, she ends the day about twice as tired as she should be.

In industry, the tricks of motion efficiency and mass production are used to make jobs easier, faster, and less fatiguing. But few of us apply the same principles to our kitchens—which are the meal-production centers of our homes. We buy automatic dishwashers, clothes washers, electric ironers, and other labor-saving gadgets, yet ignore the basic concepts of work simplification—the proper placement of kitchen equipment and materials to eliminate needless stretching, stooping, and walking.

Officials of the New York Heart Association set out recently to find ways to

Before the engineers started on it, the kitchen looked like this. Note the awkward cupboards.

Storage shelves hold a week's supply for family of four. Adjustable shelves are 6½ in. deep, 24 in. long. Vegetable bins are raised off floor.

Long-handled cleaning tools minimize stooping. All cleaning equipment is racked up or stored on shelves at right of food-storage area.

Cooking center is at left of storage shelves, which have most-used items kept at this end. Small, wheeled table will carry the roaster.

Partitioned cabinet next to stove holds serving dishes for finished foods, plus some pots. Nesting is avoided to permit easier removal.

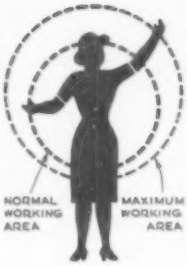
simplify the work of housewives suffering from heart disease. One way to do this, obviously, was to design a really efficient kitchen. Not one necessarily filled with expensive equipment, but one in which the working motions could be kept to a minimum through the use of carefully designed, correctly placed, and easily built cupboards, work counters, storage shelves, and cabinets.

The heart association obtained the help of college laboratories and research centers, top-flight motion-study engineers, production men, efficiency experts, psychiatrists, home-economics teachers, architects, and housewives. The result was the Heart Kitchen, which might well be called *the world's most efficient kitchen.* It is shown in the pictures on these pages. They are from a slide film ("The Heart of the Home," produced by the American Gas Association) soon to be exhibited throughout the country.

Anyone who is handy with a few simple tools can have a similar kitchen, for very little money.

This kitchen embodies principles and novel construction ideas that can be applied individually or collectively to any kitchen in any home. It is a home-workshopper's kitchen, with a place for everything and everything in a place handy to the job.

The original Heart Kitchen was designed to meet the working requirements of a woman of average height (5 ft. 4 in.). Motion-study engineers, after tests, found that a woman of this height could conveniently reach to a height of a little more than 6 ft. without stretching. They also found that without added effort she could reach forward 14 in. from the normal position of the elbow in all directions, and reach a maximum of 20 in. in all directions without tiresome stretching.



These became the basic working dimensions for the kitchen. No shelf was built higher than 6 ft. from the floor, and no working counter, or working surface, was made more than 20 in. deep.

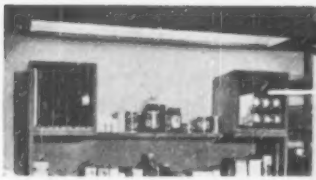
The engineers also found that the over-all length of kitchen utensils used for various purposes made a difference in the most comfortable working height for counters, the sink, and other work surfaces. So they varied the heights of the various working surfaces according to their uses.

If your wife is either taller or shorter than the so-called average woman (5 ft. 4 in.), you can plot her own individual working dimensions. Ask her to sit down at a table of comfortable height covered with a sheet of wrapping paper and hold a soft pencil in each hand. Then, have her swing one arc with each hand without

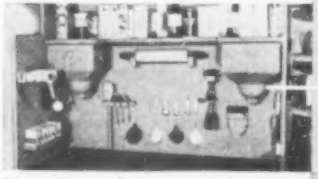
reaching. And after doing this, have her swing a second set at a comfortable reach.

These two sets of arcs will show the

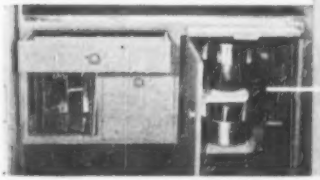
Wheeled table is stored under work surface by stove. Drawer holds silverware. Table is a big work-saver, and makes task of setting dinette table (below) a single-trip operation.



Racks above mixing center hold pie plates and cake tins. Like shelves, racks can be reached by a woman of average height.



Utensils used at mix center are ranged on the wall directly behind. Gravity-feed bins in the corners contain sugar and flour.



Bowls and pans are in cupboard beneath. Bread and pies are kept behind square door. Notice the pull-out cutting board at right.

Center for mixing and baking is carefully designed to suit the typical tasks done at this point. The counter and stool heights are related to the handle length of utensils used here. Note the multiple-shelf Lazy Susan in the corner.

normal and maximum horizontal working areas for each hand. The longest radius, measured from the forward edge of the table, is the maximum depth for any counter or working surface.

Next, thumbtack a sheet of wrapping paper up on a wall and have your wife stand facing it, again with a pencil in each hand. Have her swing vertical arcs, first without reaching, and then with a comfortable reach. The four lines she marks will form two rough circles, indicating her normal and her maximum vertical working area. The top of the topmost arc will provide a basis for figuring the maximum height for any shelf; the inner arc will locate any frequently used shelf or bin.

Basically, the Heart Association's motion-saving kitchen consists of three individual units:

- a bake or mixing center,
- a paring or vegetable- and fruit-preparation center, and
- a cooking center.

Each is arranged so that the equipment and materials needed in it are close at hand. Where duplicate utensils are helpful, they are provided. A complete complement of tools at each work center saves steps.

Either seated on a suitable stool or standing (the efficient, energy-saving housewife should avoid standing) in the baking or mixing center, the owner of a Heart Kitchen has everything within handy reach that she may need to mix a cake, toss a salad, prepare sandwiches, or roll out the dough for a pie crust. Here, because the kitchen tools that she will use most frequently are the long-handled variety (egg beaters, large mixing spoons, and the like), the counter or work-surface height is only 32 in. from the floor. This is 4 inches less than the height of the sink and the vegetable-preparation counter where, for the most part,

Vegetable- and fruit-preparation center is at right of the sink. Paring knives and vegetable brushes are racked behind, as are pots for cooking the vegetables. Peelings, outer lettuce leaves, carrot greens, and the like are simply pushed through hole in counter, falling into the tall metal container beneath. To aid in removal, this garbage can swings out with door.

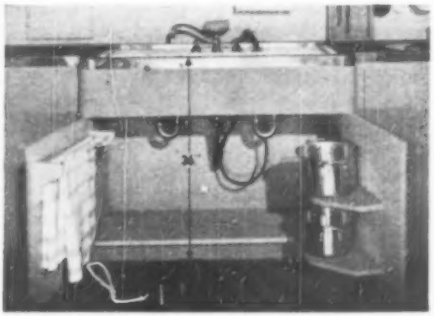
smaller, shorter-handled utensils are used.

The work height as well as the maximum working area must be comfortable. Without getting up or moving, a housewife at the mix center can reach baking pans, mixing bowls, rolling pin (mounted in a horizontal position and ready for use with no lost motions), food ingredients such as flour and sugar, and the refrigerator. A Lazy Susan made up of multiple circular shelves at one end of the mix center makes it unnecessary to reach, stretch, stoop, or even swear to pick out the right bowl.

At the paring center, which is next to the sink (as it should be), vegetables, fruits, and all things requiring water are prepared. Parings and other refuse can be scraped or pushed into a convenient disposal hole cut in the top of the counter. A container underneath catches the garbage.

Directly above the counter is a holder for paring knives and a rack for the normal cooking pots and sauce pans. Vegetables that need no refrigeration can be stored in baskets at the rear of the counter.

At the cooking center, everything required for cooking is similarly within arm's reach. Nearby storage shelves contain canned goods, seasonings, packaged foods, and the like, while a cabinet with vertical partitions holds pots, pans, and serving dishes. Heart Association experts prefer the older type of upright stove, having the oven above the range, to the newer flat-top types, because little or no stooping is necessary to use either oven or broiler.



Clothes washer (left) is housed within counter at left of sink. Soap, starch, bleach, and measuring cups are on shelves behind. Cabinet under sink (above) holds dish towels and two of the pots used for cooking vegetables. Sink is the divided type; the hose shown looped below is used for washing vegetables and rinsing dishes. A toe recess lets you stand close to the sink.

Shelf by dinette table saves extra trips back to kitchen for salt, ketchup, jelly, and paper napkins. It's also a convenient place for favorite breakfast cereals.

Shelves for dishes and glasses have open sides so that they can be used from either kitchen or dinette side. A family bulletin board is attached to the end.

The type of stool used—and it should be used for as many operations as possible—is particularly important. The one chosen for the Heart Kitchen has a comfortable back, a footrest, and a seat high enough from the floor to bring the housewife's elbows up to the level that they normally assume.

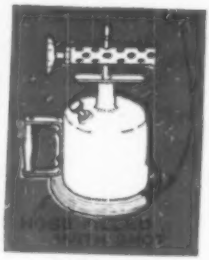
Wheels are another key feature of the work-saving kitchen. A portable table fitted with wheels not only provides extra work space that can be moved where it is needed, but makes it easy to assemble things to be transported to the dinette or dining room. Wheels on the feet of a folding ironing board also make it easier to move about. And a wheeled shopping cart can be put to dozens of motion-saving uses. It can go next to the ironing board to receive linens, it can be used to hold cleaning materials as they are carried from room to room, or it can serve as a counter-high laundry basket next to the electric washing machine.

Even your dinette should come in for careful consideration. How often have you and your family been comfortably seated for dinner when someone has noticed the lack of steak sauce, ketchup, or some other seasoning on the table and traipsed off to the kitchen to get it? Not so in the efficient kitchen (and dinette). An easily built condiment shelf hung on the wall by the table keeps everything at hand. Tricks like these will save your feet—and your heart. END

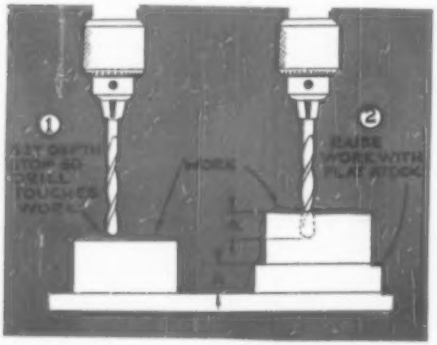
Wheels on ironing board make it easier to move when set up. Folding rack for finished work saves steps. Housewives are urged by Heart Association to sit when ironing. Best stool height keeps elbows same distance from ground as they are when you stand. Support clamped to board keeps iron's cord from dragging.

Lathe Subs as Sander. If you lack a regular sander, a substitute can be assembled from a sanding belt, a flat pulley, a length of plank or two-by-four, and a couple of clamps to hold the rig to the bed of the lathe. A large chuck serves as the drive pulley. Hold the work in one hand and a backing block in the other, under the belt.—*R. H. Peters, East Holliston, Mass.*

Holds Handle. A sliding vise handle is often a nuisance because it gets in the way of tools or some part of a machine to which the vise is attached. In such cases, the handle can be kept in position by looping a rubber band around it as shown. Here the vise is mounted on a milling-machine table. The band keeps the handle out of the way.

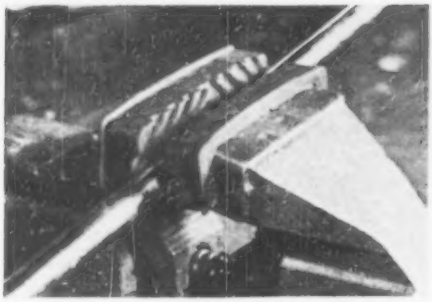


Weighted Hose Holds Torch. A gasoline or alcohol blowtorch is often damaged if it tips over and rolls off the workbench. The chance that this will happen is lessened if you weight the base. Cut a piece of garden hose long enough to encircle the torch. Fill with lead shot and tape the ends together.—*M. L. Rhodes, Knightstown, Ind.*



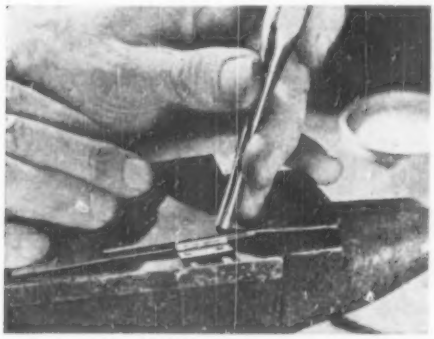
Drilling Blind Holes. To drill blind holes to a precise depth, place the work on the drill-press table, lower the drill so the point just touches the work (1), and set the depth stop. Then raise the drill and put under the work a piece of flat stock that's exactly as thick as the desired depth (2).—*F. Strasser, Santiago, Chile.*

Metal Foil Makes "Notes." Aluminum foil can be used for making quick and accurate records of screw threads, hole spacing, shapes of parts, and other details involved in shop work. The piece of foil can then be used as a gauge in selecting duplicate parts from your bin or at the hardware store.

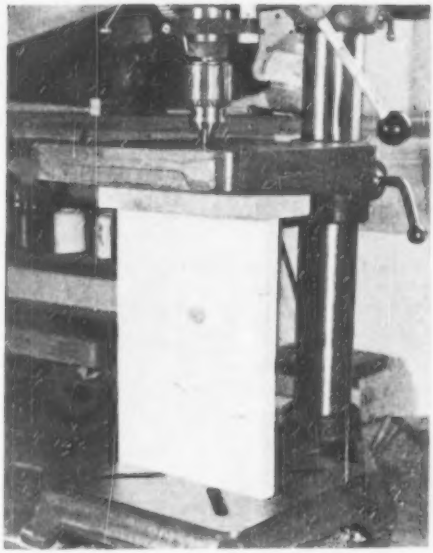


Tread Pads Vise Jaws. Cut in half, a rubber snap-on pad for an automobile brake pedal makes an excellent pair of jaw pads for a bench vise. Pick a size that just fits the vise jaws.

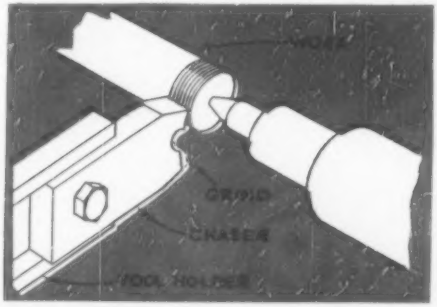
Flat on Scriber Cuts Better. If a tiny flat is ground off on its tip, a scriber will cut a hairlike chip when held at any working angle. The flat tip can be touched up vertically several times before the little circular cutting edge becomes too large to cut a fine line. When this happens, sharpen the tip and grind a flat again.—*H. Pfister, The Bronx, N. Y.*



Setting Hinge Flush in Metal. One way of sinking a hinge flush with a sheet-metal part, especially soft metal, is to place the hinge on a flat steel surface, the sheet metal on top, and then a sheet of rubber. When hammered, a punch will squeeze the metal down around the hinge leaf.—*Walter E. Burton, Akron, Ohio.*



Press Doubles as Clamp. If you need to glue up wide boards and have run out of clamps, just put them between the unclamped table and base of your drill press. —*Roland Cueva, Heyburn, Idaho.*

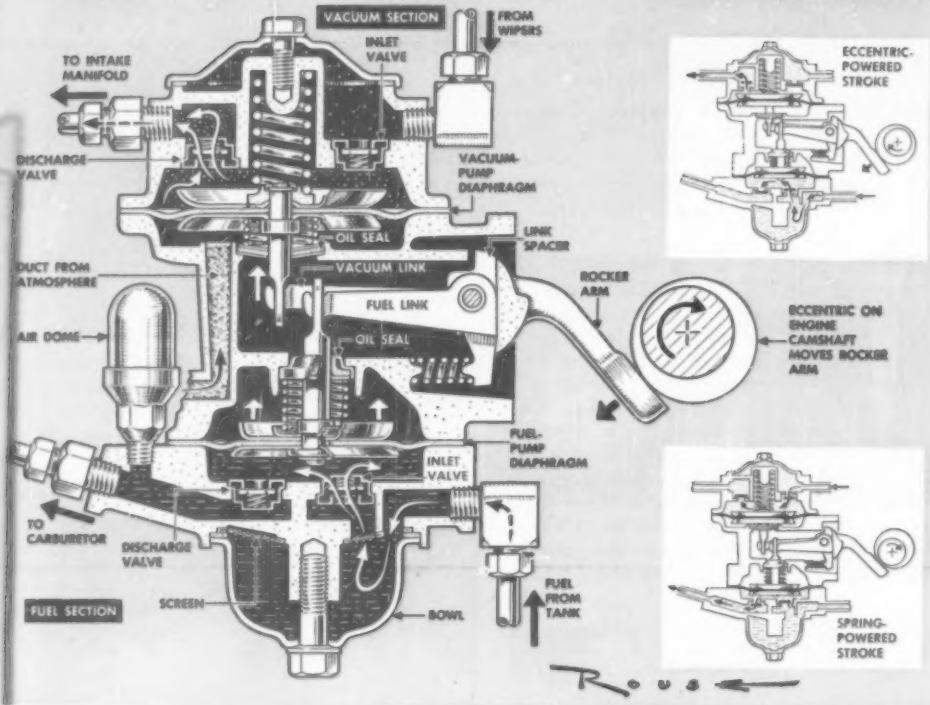


Threading Duplicate Parts. For short production runs, you can adapt the chaser of a threading die as a simple and effective multiple-point threading tool. Mount it solidly on a steel holder, and grind off the lower edges if necessary.

Describing the idea in *Tool Engineer*, Arthur R. Christensen, of Lockport, N. Y., explains that the tool should be adjusted so the cutting edges of the chaser are at center height. The body of the chaser is set at 90° to the work. Although not ideal for high-class fits, the tool is a definite time saver for a wide range of threading jobs.

Common trouble sources in a fuel pump include, left, rust and sludge choking the filter bowl and screen; and at right, a ruptured pump diaphragm.

Inside of combination pump is shown below. This is AC's type AJ, used on several recent cars. Vacuum side works wipers if engine vacuum drops.

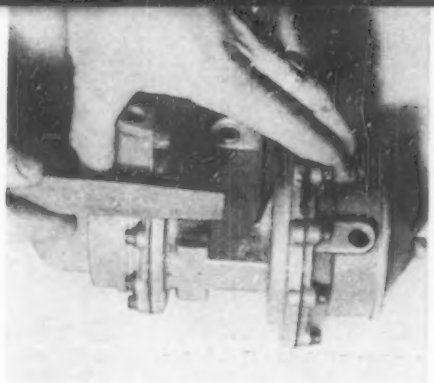


How to Overhaul a Fuel Pump

By E. F. Lindsley

SOME mechanics say an ordinary guy should keep his mitts off a fuel pump. An overhaul, they argue, is a specialist's job. But I've done it, very successfully, and I'm no specialist.

Although mechanical fuel pumps come in various shapes and sizes, they all work on the same principle. Some simply pump gas to the carburetor. Others, like the type above, also have a vacuum section to keep the wipers operating when the manifold vacuum drops. The simple pumps, naturally, are easier to overhaul. But patience and reasonable care will keep you on top of



File a mark on diaphragm flange before taking a pump apart, so you can reassemble it same way. Wash dirt off with suitable solvent.

Lay out parts neatly in order of disassembly. This makes it easier to put pump back together properly after you have fixed it.

even the more complicated ones. Service procedures are roughly similar for all types.

What are the trouble signs? A fuel pump is faulty if it pumps too much or too little gas.

Gasoline dripping from the carburetor, rough idling, and hard starting may point to a pump that's delivering too much fuel.

But the trouble is quite likely to be outside of the pump. A defective automatic choke, punctured carburetor float, defective needle valve, improper carburetor adjustment, or loose carburetor assembly screws may all deliver too much fuel to the engine. If none of these troubles is found, however, the pump probably needs overhauling.

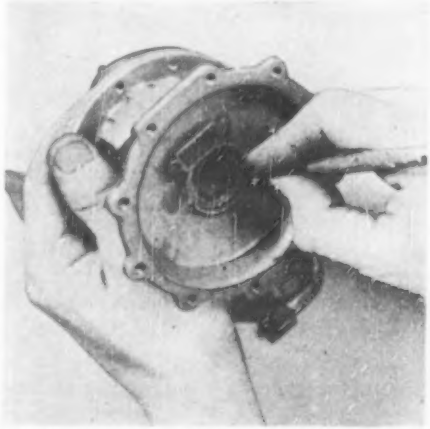
Dying out, poor acceleration, hard starting, low power, and popping back in the intake manifold may be symptoms of too little gas—although some of these might also result from a leaking or plugged fuel line, or carburetor trouble.

High oil consumption often is traceable directly to a ruptured fuel-pump diaphragm pumping oil from the crankcase. On the vacuum side of a combination pump, this may show up as blue oil smoke in the exhaust.

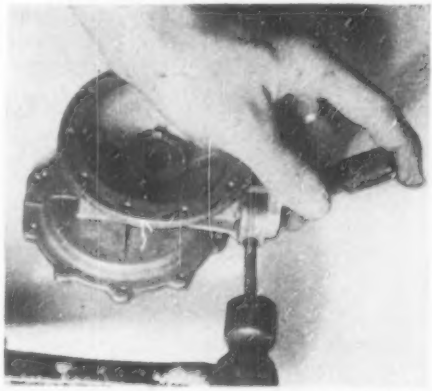
One of the surest signs, of course, that something's wrong with the vacuum pump is slow action of the wipers while you're climbing a hill or accelerating.

Checking for leaks. When the pump seems to be weak, make sure there's gas in the tank and go over the lines for leaks. Then disconnect the fuel line at the carburetor, slip the end into a clean bottle, and have someone step on the starter—ignition off. A good pump should spurt fuel vigorously.

If a pump's delivery is weak, check for diaphragm-flange leaks by applying a

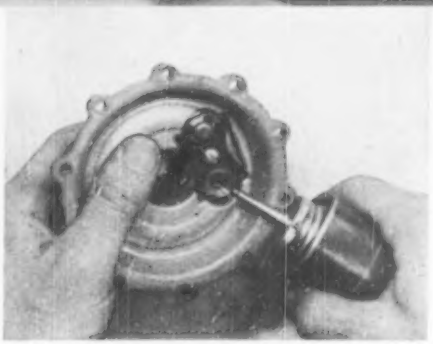


Diaphragm pull rod in this pump hooks on the rocker link. Some engage in a different way. Attaching one may require patience and care.



Keep rocker arm aligned with pivot-pin hole, or use a drift, when installing the pin. Stake pin with a punch to keep it from working out.

Install new valves and gaskets exactly as old ones came out. Watch whether large or small end of each valve cage goes down or up.



A drop of light oil aids new valve. To avoid mistakes, leave the old valves in place until ready to install new ones. Keep valves clean.

Flex diaphragm to its full stroke when tightening the flange screws. For square seating, alternately tighten screws directly opposite.

Test pump manually before completing the job. Here, thumb over the inlet checks the suction. Make the test before installing vacuum side.

little saliva—or heavy oil, if you're fastidious—and watching for bubbles. Should you find a leak, tighten the cover screws alternately on opposite sides. Continued leaking indicates a bad diaphragm.

If the diaphragm flange is okay, check for a leak around the bowl gasket. Also remove and clean the bowl and screen. This should always be done anyway at least twice a year. It's frequently neglected.

Removing the pump. If tightening and cleaning fail to revive a pump, it should be removed and overhauled or replaced. Some pumps have a thick pad under them to locate the rocker arm properly against the camshaft eccentric. Do not lose this.

Clean away all traces of the old gasket and be sure to use a new one.

A rupture in the diaphragm may be the only trouble. Other defects such as a broken rocker arm, worn or defective linkages, or a broken spring may be discovered, however, while the pump is being taken apart.

While tearing down the pump, notice how the diaphragm pull rod engages the rocker link. Some take only a half turn to right or left to disengage, others hook on, and many have link pins retained by spring clips.

The spring-clip setup permits replacement of diaphragm sheets without removing the pull rod. To do this, soak the sheets in kerosene, slip them over the pull rod, and hold them aligned with a few flange screws through the edge holes. To avoid wrinkles, tighten the top nut while keeping the lower alignment washer from turning.

When you finally assemble the diaphragm sandwich between the cover and the body, the diaphragm should be flexed to full stroke before completing the screw tightening. If clamped when stretched flat, the diaphragm couldn't work without tearing.

It's easier to install the rocker-arm pin against spring pressure if you make a drift out of a rod or nail about the same size as the pin. File the point to a taper and use it to line up the hole. END

Thick-Shelled Atom

THE most complicated atom, that of uranium, has seven shells of electrons around its nucleus.

Play All Three On Your Old Phonograph

By J. Raymond Schneider

YOUR old record player may not be as out-dated as you think it is. If your record collecting has been slowed down because your phonograph can't handle the new slow-speed records, here's a way to bring that platter-turner up to date: an all-electronic system that turns any 78- r.p.m. synchronous motor at 33⅓ and 45 r.p.m.

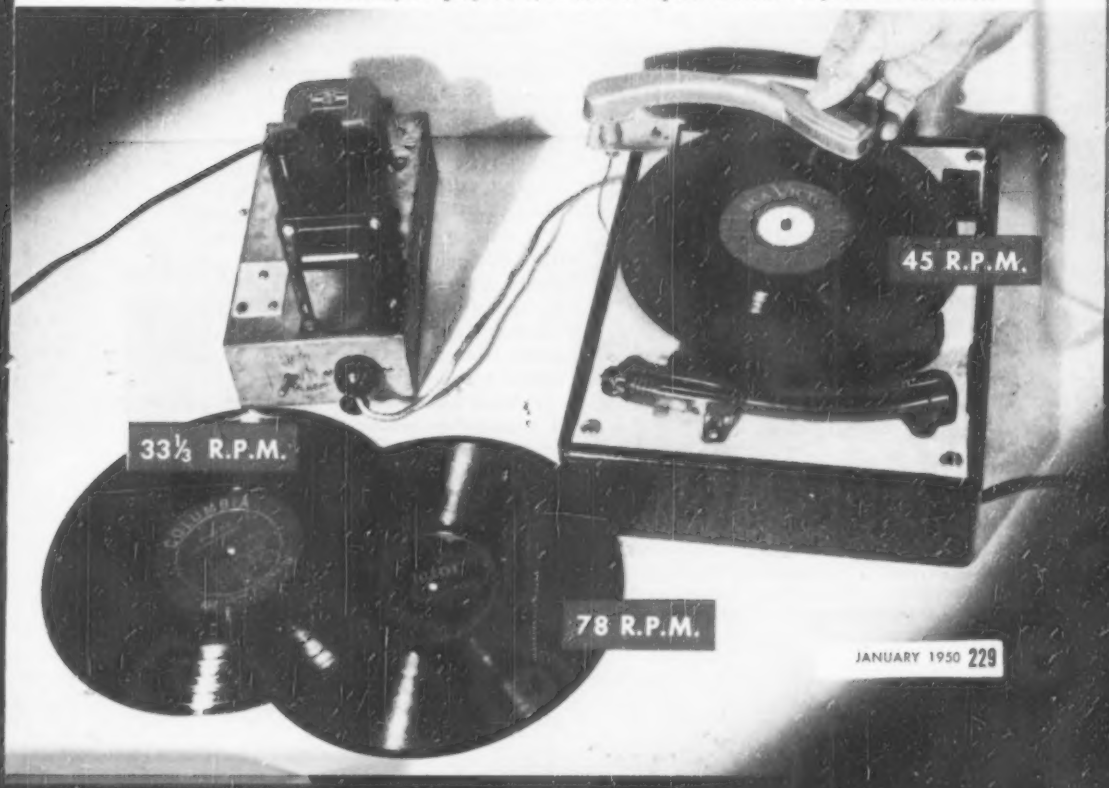
Fundamentally this unit consists of a variable-frequency generator. Since synchronous motors turn at a speed that is governed by the frequency of the house current (usually 50 or 60 cycles) it is only necessary to vary the frequency to vary the speed.

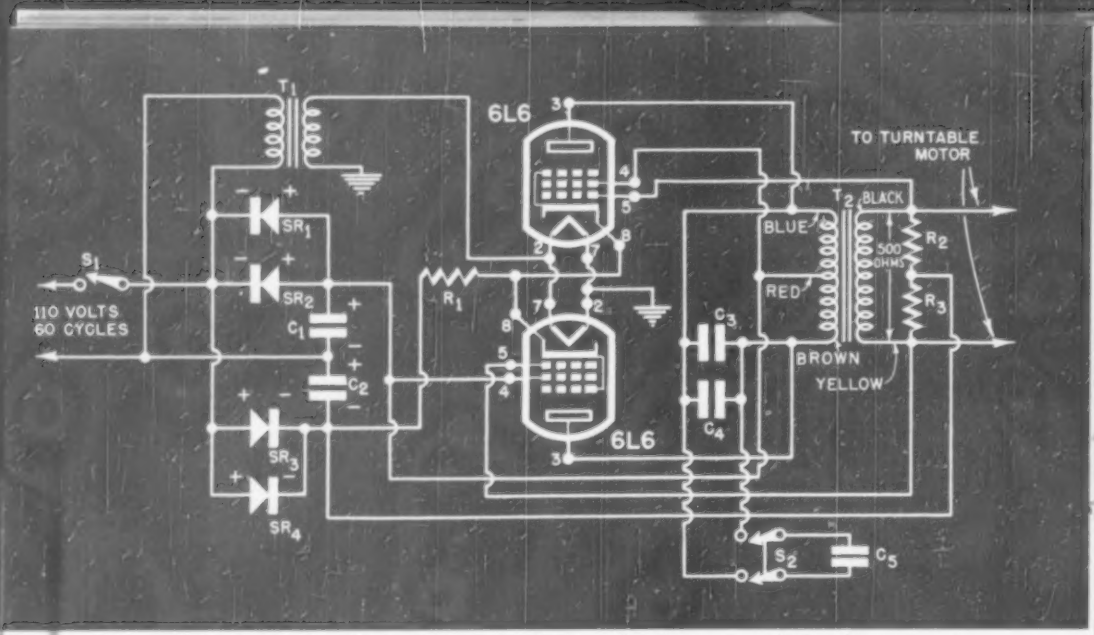
The generator shown here uses standard radio parts and requires few tools. It is important that the components be of heavy-duty construction in order to achieve the necessary power-handling capacity.

An audio-oscillator circuit using two 6L6 pentodes in push-pull does the main work of frequency changing. Power is supplied by a voltage doubler consisting of four dry-disk selenium rectifiers and two filter condensers. Output of the oscillator goes to a push-pull output transformer, T2. Condensers C3, C4, and C5 are connected across the primary of this transformer to produce a resonant circuit. It is important to use the particular output transformer (T2) specified in the parts list. The 5,000-ohm primary of this unit has two leads for the plate and one for B-plus. On the secondary side you use only the black and yellow leads (the 500-ohm tap).

Note that two condensers (C3 and C4)

Change speeds electronically to play 33 1/3- and 45-r.p.m. records on your old turntable.



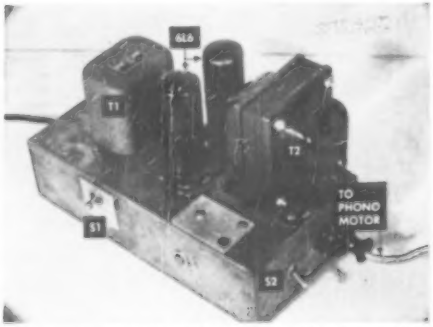


This oscillator, using standard radio parts, changes the frequency of the line current.

LIST OF PARTS

C1, C2: 30-mfd., 450-volt electrolytic.
C3: 1-mfd., 450-volt paper or bathtub-type.
C4: .25-mfd., 450-volt.
C5: .5-mfd., 450-volt.
R1: 100-ohm, 10-watt wire-wound.
R2, R3: 30,000-ohm, ½-watt carbon.
SR1, SR2, SR3, SR4: 100-ma. dry-disk selenium rectifiers.
T1: 6.3-volt, 2.5-amp. filament trans.
T2: Push-pull output transformer (Stancor, A-3800; 5,000-ohm primary)
S1: SPST toggle.
S2: DPST toggle.
Two 6L6's, line cord and plug, female outlet receptacle.

are permanently connected across the primary of output transformer T2. This combination should cause the turntable to run at 45 r.p.m. A third condenser, C5, is connected in parallel with the other two by means of switch S2. The effect of adding this condenser is to lower the resonant frequency of the circuit, cutting speed to 33⅓.



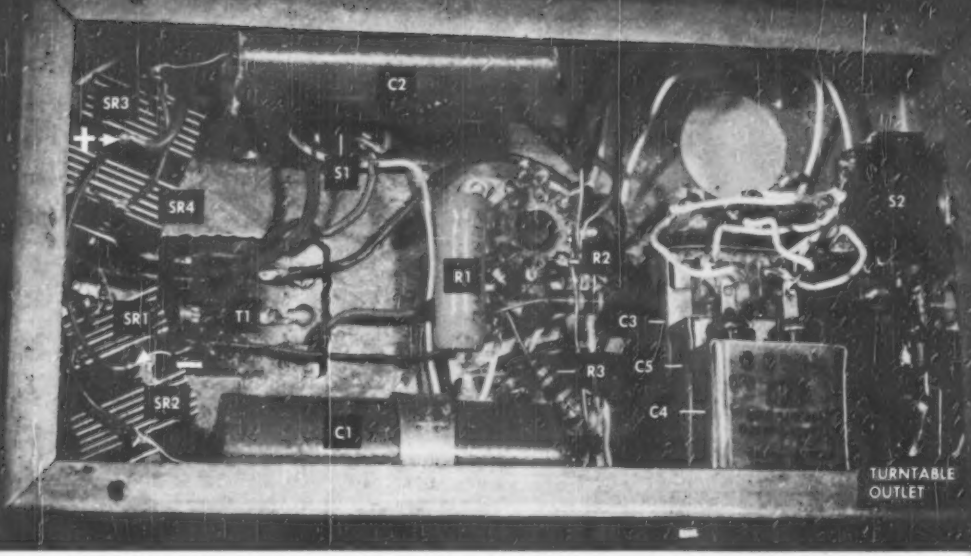
The converter is connected to the house line and the phono motor plugged into the flush-mounted receptacle on the edge of the chassis.

There are many variations in phono motors. Use a stroboscopic disk to find the exact speed yours delivers when powered through the frequency changer. You may discover that it is turning a few revolutions faster than you want. Should this happen, add an extra 450-volt condenser in parallel with C3 and C4. First try a .1-mfd. unit. If the speed is still too high, add another.

If the 45-r.p.m. position is correct but the 33⅓ slightly high, add the .1-mfd. capacitor in parallel with C5. Conversely, if the motor is too slow, replace C3, C4, or C5 with slightly smaller capacitors. A small amount of experimentation should put the turntable speed right on the nose.

A second basic change in the new records is a narrower groove that requires both a sharper stylus and lighter pickup pressure.

The simplest solution to this end of the problem is to add a lightweight arm with a narrow-groove stylus at some convenient place on the motor-mounting board. The photo on page 229 shows this additional tone arm. The shielded lead from this arm is wired in parallel with the other one.



The position of most components can be seen here. Note the polarity of the dry-disk rectifiers.

To operate the frequency changer, plug the line cord into a 115-volt AC outlet. The power leads from the 78-r.p.m. motor are plugged into the receptacle provided on this unit. Allow the tubes a few seconds warmup, turn the switch to either the 33⅓ or 45 position, and play your new records.

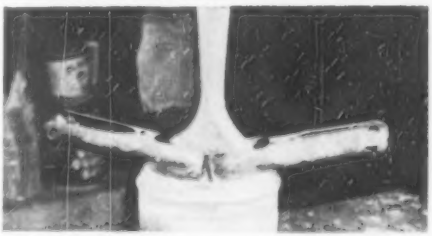
This converter has enough power to handle the phonograph motor *but not the amplifier*. If your phonograph has a single plug for both the motor and amplifier, it is necessary to separate the wires. Plug only the phono motor into the converter; the amplifier and radio go to the house line.

Depending upon your own particular cabinet arrangement, you may wish to connect the switches through extension cords. This will allow you to hide the converter while bringing the controls to the front. In this event it may also be desirable to add a DPDT switch between converter and motor. Wire it with the motor leads running to the blade contacts, house current to one side, and converter output to the other. This gives a choice of the slow speeds or a feed-through arrangement that will connect the phono motor directly to the 115-volt, 60-cycle line. The latter position will be used when you want to play your phonograph at its original speed of 78 r.p.m. END

Brush Stays Soft in Bag

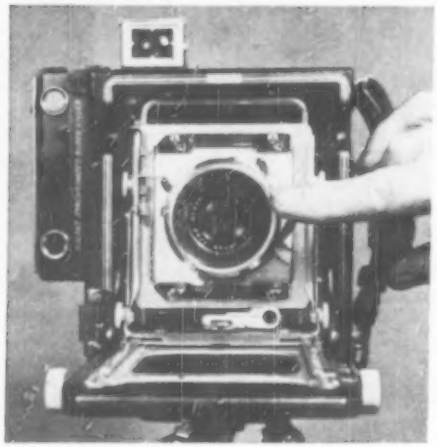
When you've finished painting, all you have to do is brush out the excess paint and then store the brush in this plastic bag after adding an ounce of turpentine. The brush will stay pliable. It's important to twist the top of the bag tightly and bend it over as shown in the photo. A rubber band or string secures the top. The Baldwin Sales Co., Brooklyn, sells bags of three sizes.

Clamps Suspend Paint Brush



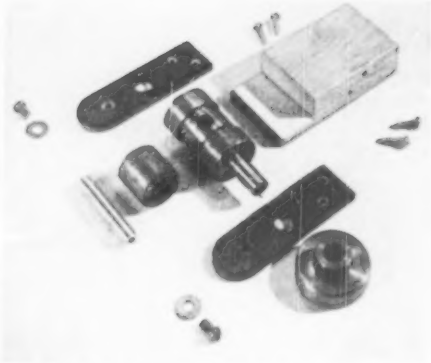
An easy way to suspend a paint brush in thinner without allowing the brush to rest on the bristles is to snap on a couple of spring clamps or glue tongs.—*Steve Sontra, Jr., So. Norwalk, Conn.*

PHOTO IDEAS AND EQUIPMENT



Shoot Through It. If you're missing pictures by forgetting to take off the lens cap before shooting, why not try this? A window of good, clear acrylic plastic, held in a filter holder, as shown above, or fitted into a hole cut in your lens cap, will protect the lens without obstructing it.—*J. P. Arnold, Doylestown, Pa.*

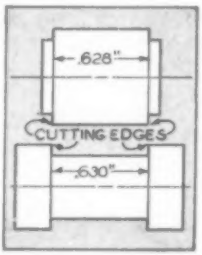
Lets You Get Close. This new close-up attachment fits any camera, movie or still, and insures sharp focus for objects only six inches away. A base plate, to which the camera is attached, also supports the lens holder through a rod-and-clamp arrangement. The holder can accommodate seven different lenses. Called the Ultra-Focuser®, it is made by Hollywood Cine Products, Elsinore, Calif., and retails for about $10.

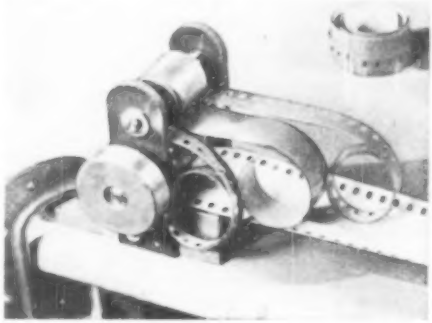


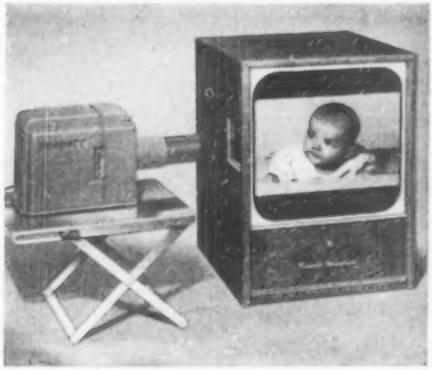
Film Cut to Fit. Used in total darkness, this homemade film slitter quickly trims standard 35-mm. film to fit the new midget cameras that require unperforated 16-mm. stock. This lets you use infrared, supersensitive, and other special films.

Working parts are two rollers of cold-rolled steel. In one roller, machine a groove exactly as wide as the film you need (.630″ for 16 mm.). Cut shoulders on the other roller to leave a section .002″ narrower than the groove of the first roller. Both roller faces should be slightly concave so the metal won't scratch the film. All shoulders must be straight and sharp.

Mount the rollers on arms as shown, with the lower, grooved roller fastened by a recessed setscrew to a shaft having a crank or handle. The other roller spins freely on its shaft, which should be adjustable so it will fit closely in the groove of the lower one.—*W. E. Burton, Akron, O.*





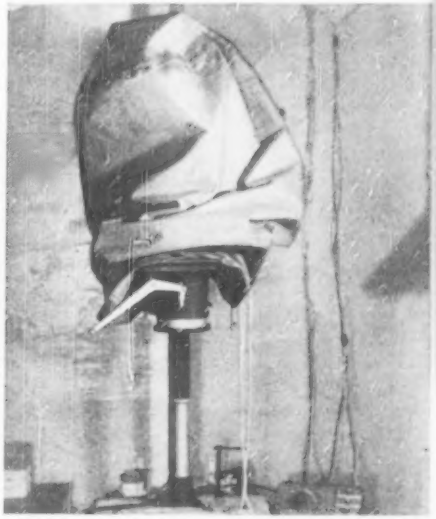


It's All Done with Mirrors. With this viewing unit, you can project slides and movies without setting up a screen or darkening the room. A projector is pointed at its side as shown, and polished plate-glass mirrors in the cabinet reflect the image at a 90° angle and project it onto a darkened, built-in viewing screen. Made by the Kinnard Co., of Milwaukee, it sells for about $15.

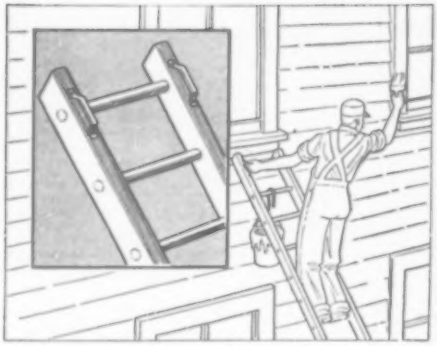
Guide Matches Photo Tones. Shaped like a four-leaf clover, this Agi-Tone® guide helps novice photographers get the desired tones in prints. Its four plastic leaves are different shades of gray for normal flesh, tanned flesh, mid-key values, and dark tones. A hole in each leaf lets the print show through so it can be matched to the guide. And when your developer turns the same color as the amber handle, you know it's time to renew the solution. The guide is made by Arpin Products, Orange, N. J.

Film-Editing Base Folds. A new folding base is now offered by the Craig Manufacturing Co., of Los Angeles, for its line of home-movie Projecto-Editors®. It permits the entire combination—rewinds, splicer, and all—to fold compactly into a small carrying case, as shown above.

Light Stand Does Double Duty. Increase the usefulness of your photographic light stand by having standard ¼"-20 tripod threads cut on the center rod. You can then use it to support a small camera if your tripod is tied up.



Enlarger in the Bag. Rubber barracks bags, available from most surplus stores, make excellent dust covers for photographic equipment. The bag just fits over an enlarger of medium size and the draw strings enable the bag to be tightly closed. Ferrotype tins can be protected from dust by the same means.—*Richard C. Collins, Jr., Elizabeth, N. J.*

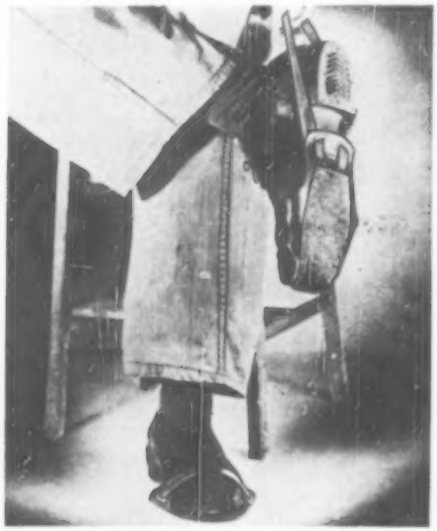


Handles Give Ladder Hold

WORKING up at the top of my extension ladder is pretty slippery business with only the paint-spattered uprights to grasp. Adding on door handles has made me feel more secure. I now have a firm handhold when I lean over to the side. One caution, though —don't get overconfident and lean too far.—*William A. Rice, Hartford, Conn.*

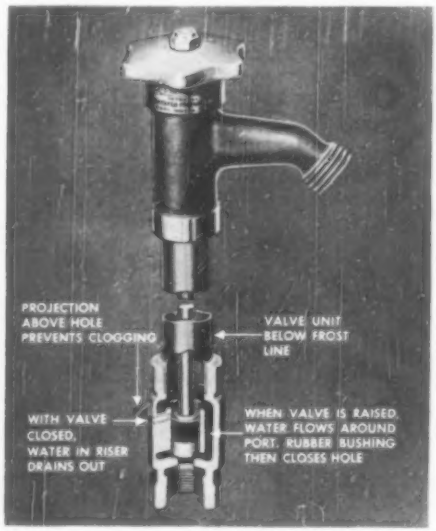
Stretches Paint Cans

ADDING color or thinner to a full can of paint is a cinch with the Canstrecher®. You just pry the lid off the can and fit the extension in place. Then, after thinning or adding color, you stir the paint or put the stretcher's lid on and place the whole unit in a paint shaker. The extensions are made by Samson Metals Co., of Miami.



Safety Tread Prevents Slips

THIS sandal-like safety tread has a tough, replaceable abrasive strip on the sole to prevent slipping on icy streets. It also can be used by stream-wading fishermen. The New Products Development Corp., Schenectady, N. Y., makes the treads in three sizes to fit shoes or boots for men and women. They're small enough to fit in a pocket or handbag.



Yard Hydrant Can't Freeze

THIS yard hydrant works like a big one. When you close the valve, water trapped in the riser drains out an underground port, preventing damage caused by freezing. The hydrant is made in seven lengths—from 3½′ to 6½′—by Strataffo Products, Fort Wayne. The valve moves up and down, instead of turning, to lessen wear on the valve seat.

Servicing Intermittent Radios

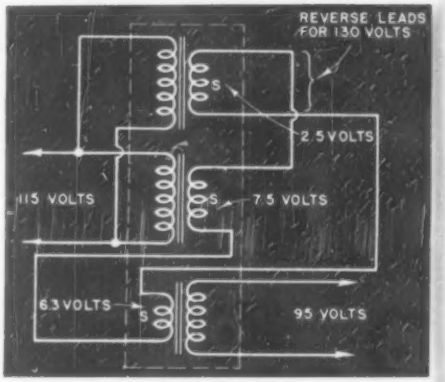
If you've ever tried repairing radios you know what a headache an "intermittent" can be. Some sets have elusive troubles that come and go by themselves. They almost always seem to happen when you're listening to a good program but disappear as soon as you drag out your voltmeter.

Rather than waste time waiting for them, you can hustle these troubles into the open by creating tough operating conditions. The three that show up intermittents most quickly are overheating and boosted or lowered voltage.

Quick heating can be achieved as shown in the photo at the right. Connect a 100- or 150-watt bulb, place it next to the chassis, and cover both with a cardboard carton. The locked-in heat will give the effect of an hour or two of playing in a few minutes.

A couple of old filament transformers or windings can be used to tamper with the line voltage. Rigged as shown in the sketch, the 2.5- and 7.5-volt transformers are bucking each other. Their combined output is fed to the 6.3-volt winding of the third unit and results in a total output of about 95 volts. Low line voltage often causes a defective oscillator to stop operating.

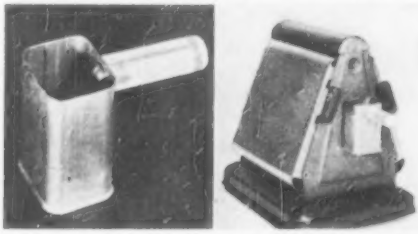
Reversing the leads on the 2.5-volt transformer puts it in series with the 7.5-volt winding and boosts the line to about 130 volts. High voltage gives a fine imitation of trouble-causing line surges.



Socket Premounts Radio Parts

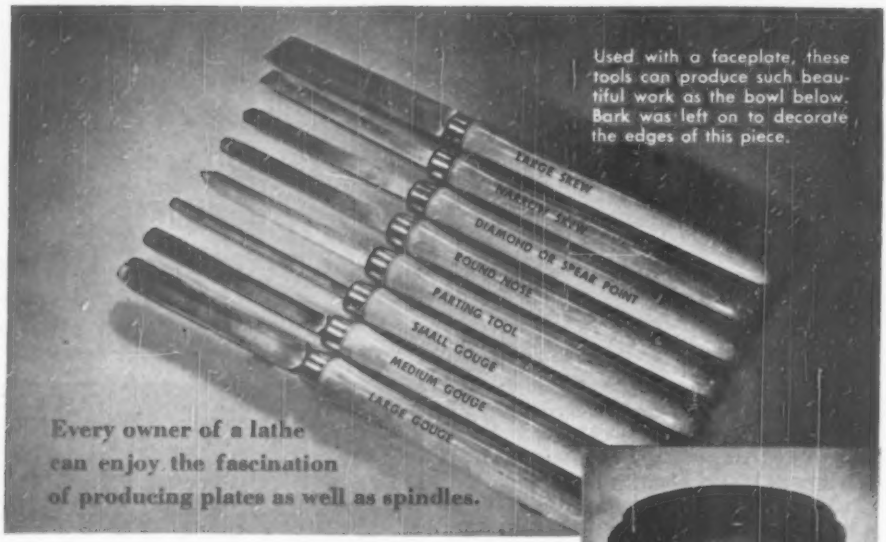
Radio and electronic circuits can be assembled in stages with the aid of a new tube socket made by Vector Electronic Co., Los Angeles. The socket itself is the same as conventional types but a plastic turret is bonded to the lower part. Lugs on the turret permit mounting of associated parts. This arrangement makes it possible to do much of the wiring outside the chassis, increases the usable depth of the chassis, and reduces lead length. Sockets come in all common types.

Butter Warmer Fits Toaster



Cold butter is not only hard to spread but also tends to cool your toast too rapidly. This warmer gives you easy-spreading butter along with your toast, for it hooks right on the toaster and takes heat from it.

Almost any small can (except the lacquer-lined type) can be used. Check it first with water to be sure it's leakproof, and then cut it to size, leaving a little tab on the front. Attach a wooden or plastic handle with a wood screw. Drill a ¼" hole in the side of the toaster and hook the can on.—*Arthur Trauffer, Council Bluffs, Iowa.*



Used with a faceplate, these tools can produce such beautiful work as the bowl below. Bark was left on to decorate the edges of this piece.

Every owner of a lathe can enjoy the fascination of producing plates as well as spindles.

Turning Disks and Bowls on a Lathe

By Edwin M. Love

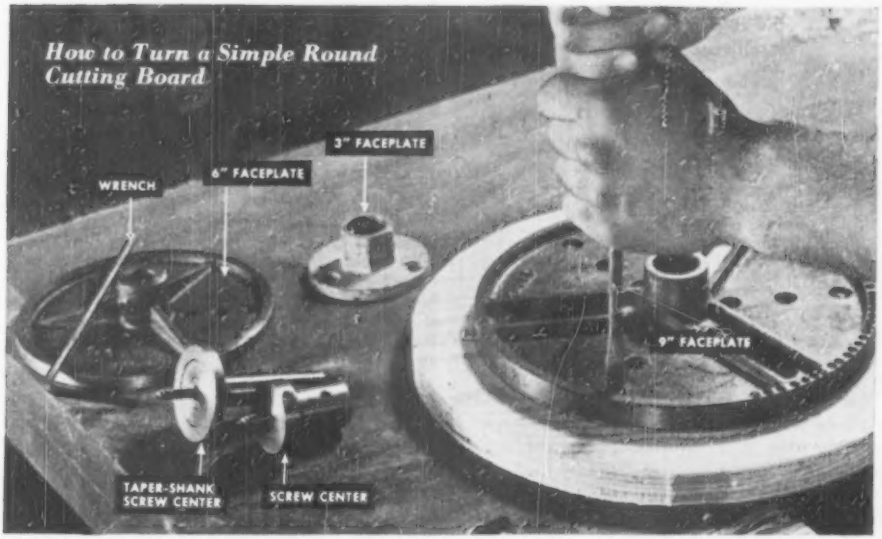
IF ALL lathe work had to be turned between centers, it would be hard to make bowls and trays, since the tailstock center would be constantly in the way. For work like this the faceplate is ideal. It's a metal disk, driven by the headstock spindle, to which work can be directly screwed, eliminating the need for tailstock support. Some faceplates screw onto the spindle, others are clamped on it with setscrews, and a third kind has a taper that fits the spindle.

How to begin: A simple, round cutting board, 6" or so in diameter, is a good project for a beginner. Draw a circle on a suitable piece of wood the size you want your board to be, and then draw a slightly larger circle around the same center. Jigsaw or bandsaw the board to the size of the larger circle. If you don't have such saws, simply cut the corners off to make a rough octagon.

To make the guideline on the face of the work before cutting the disk down to its final size, some workers use dividers. One point is aimed at the center and the other is forced against the work. Be careful not to scratch the face or let the points dig in.

When you are ready to sand the board, remove the tool rest and move the sandpaper evenly from the center to the edge. The central areas travel more slowly, so they must be sanded more than outer areas.

To decorate the edge: It can be scored with the skew point. Then, if you wish, you can make beads by rounding off the sharp edges of the channels. Or you can scrape a cove in it with the round nose.



Choose a faceplate big enough for the load it is to carry. Center it in a circle the diameter of the faceplate. Use short screws so as not to prick through. You will need three screws to hold a large blank to a faceplate, but a screw center (two are shown at left center above) will hold small work. Mount the faceplate on the lathe, belt your machine for its slowest speed, and stand aside for safety's sake when you start it. Then proceed as shown in photos below.

True the edge first to balance the blank. Do this by holding a narrow skew chisel flat on the tool rest (set close to the work and a little below center), and thrusting it in from the face. Don't cut clear through; leave a little web along one side to be scraped off later when turning to final size. Right-angle rest shown is handiest for faceplate work.

True the face by making a light scraping cut with a gouge, moving from the center to the edge. By lowering the handle and rolling the blade to the left, you get a sort of shearing cut. Don't go in deep enough to hit the screws. Use a sharp, wide skew or a square-ended chisel to flatten ridges. Stop lathe and use straightedge to test for uneven turning.

Finish the piece by cutting the edge down to a guideline with the skew this way. To draw the guideline on the face, touch the whirling piece with a pencil near its center. You'll get a small circle. A second try will give you a tinier circle or a black point. With dividers or compass set to the radius wanted, and the point centered, scribe the guideline.

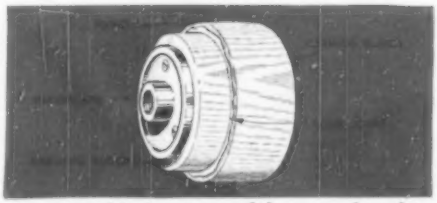
Now turn the page, please, for more about faceplate turning.

Tips on Turning Wooden Bowls

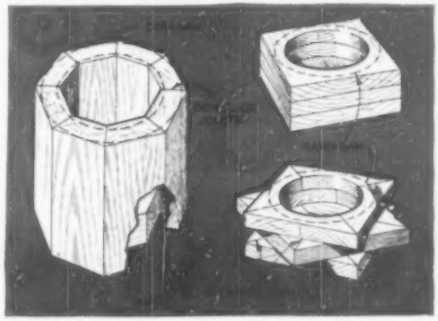
FAIRLY large turning blocks can be obtained from craftsmen's supply houses. Since they are kiln-dried, they will hold their shapes nicely after turning, without cracking. But often you can find material in your own back yard—a chunk from the crotch or stump of walnut or other hardwood—that will yield a beautifully figured piece. By leaving on some of the bark, you get the attractive effect shown in the fruit bowl on page 236. This, incidentally, was made of two pieces, a bowl and a base, screwed together.

At this season, your best bet for home-grown turning stock is a thoroughly seasoned woodpile. Using freshly cut stock is a waste of time and effort, for the turned pieces made from it will almost certainly check and crack on drying.

Wood intended for turning should be cut in late summer and seasoned for a year. If you want to leave the bark on part of the piece, white ash is a good choice as its bark stays on indefinitely. Maple and birch bark, on the other hand, chip easily and do not remain on the wood long.



Mounting blocks are used between faceplate and work to turn bowls with thin bottoms. After the work is turned, it is split off the backing.



Glued-up stock can be used for many pieces. Grain patterns then can be arranged to suit your fancy. Three ways of doing this are shown.

How To Turn a Simple Bowl to Shape

Rough-turn the outside with the gouge, moving it with the grain, after truing up your block. In this case, block was screwed to a 3" faceplate with grain running toward exposed face. If grain were crosswise, first cuts should be made in from the face. But generally speaking, cuts started at the corner should be avoided.

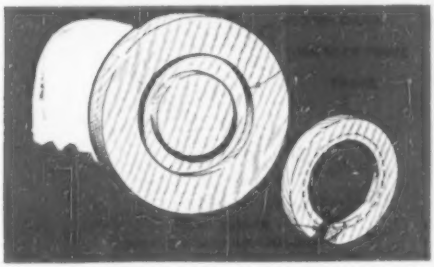
Recess the bottom with a round-nose chisel, after shifting tool rest. Hollowing it this way means the finished bowl is less apt to rock on a table or shelf. The base diameter here is such that the faceplate screws will be able to enter the rim when, as the next step, you reverse the work so that you can hollow out the inside.

Mark a screw location on base with a pencil (see below) after locking spindle with indexing pin. Count index holes for 120°, relock, and mark second screw location. Then take the work off faceplate and attach it by other end. Despite your care, bowl will be slightly off-center. Hence, only rough-turning is justified up to this point.

Hollow the bowl by cutting in with the point of skew held as for edge-trimming but with the long point at the left. A little gouge work is possible, but the small diameter eventually calls for the round-nose scraper, here undercutting the rim. It also quickly smooths a rounded bottom. Then do final outside turning and sanding.

To Make a Picture Frame

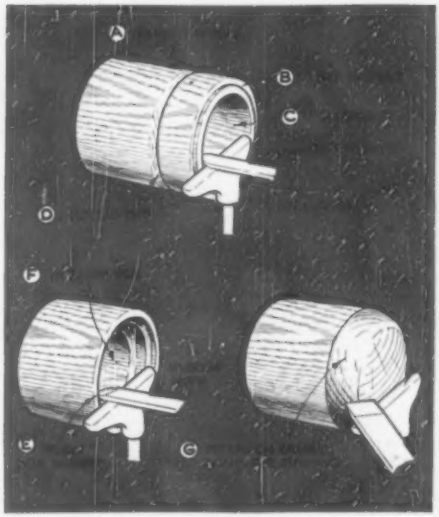
Cut out center after turning piece on front and edge. Run lathe at slow speed while severing last fibers. Frame then will drop back on the spindle without being thrown or marred.



Turn a chuck with groove recessed to fit the frame snugly. Force the frame in face to back. Then turn the rabbet for the glass. Put a sheet of paper inside recess if chuck is loose.

Make ball feet for your frame this way if you like. Block is mounted on screw center here. Each foot piece then can be turned the same way that you would if making a tiny bowl.

To Turn a Box With Lid



Rough the block mounted on a faceplate or in a chuck. After roughing the outside, turn the inside of the lid with its rabbet. Then cut off the lid. Hollow inside of box, making a rabbet to chuck the lid. Snap the lid on and complete outside turning and sanding. If piece is fragile, it's a good idea to leave hollowing of box to last. Sand a free rabbet fit for lid then, before taking the work off the plate.

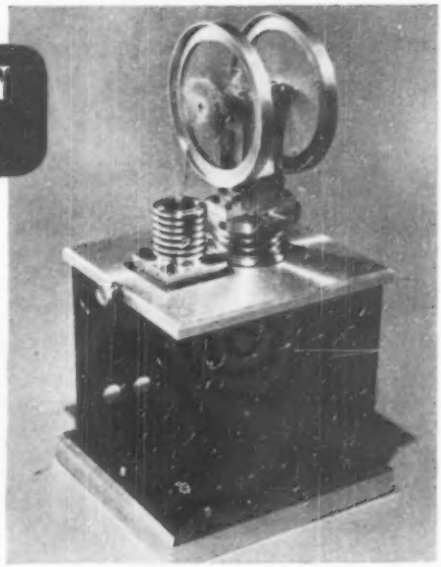
Turning large pieces: Work too big to swing over the lathe bed can be turned outboard, at the outer end of the headstock. A faceplate for this must have a left-hand thread. A floor stand is used to support the tool rest while the turning is done.

Remember that the bigger the piece, the slower lathe speed should be, especially when work is rough and unbalanced. END

White Lacquer Boosts Stair-Tread Visibility

WHITE or light lacquer on your cellar stair treads will make them easier to see and hence safer. In the photo white lacquer is being brushed on a tread having an embossed design. The coat on top of the ridges will wear away in time, but the portion in the valleys will remain almost indefinitely. Quick-drying auto lacquers can be thinned and brushed on. They dry so quickly that stair traffic is not seriously interrupted. In the quantity ordinarily used, the solvents won't affect the rubber noticeably.—*Walter E. Burton, Akron, Ohio.*

CRAFTSMEN AT WORK

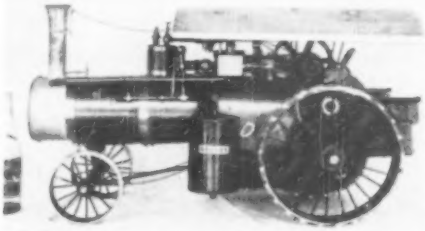


Hot Air Runs It. A tiny alcohol flame spins the hot-air engine shown at right and inset. Built by an engineer whose hobby is unusual engines, it copies an old Bavarian toy. The displacer cylinder consists of two halves, joined at a dural plate that serves as a heat bafflle. The power cylinder is bolted atop the baffle at the left. The air passage joining the cylinders was drilled through the plate edge.

Bandsaw. Wanting a large-capacity bandsaw that could cut metal, Carl Porter, of Bayonne, N. J., built this one in four months at a parts cost of $50. Its three-wheel arrangement gives large throat capacity with low headroom and small wheels. A speed reducer below the bench gives the slow speed necessary for metal work. The big table tilts a full 45°.

Tame Lightning. This Van de Graaff generator was built by Donald Cohen, of Cleveland Heights, Ohio, from PS plans (Oct. '46, p. 188) for instruction in his physics class. It throws an 8″ spark. Instead of a tube, he used ¼″ plate glass for the upright. The globe is covered with foil.

Skims Over Snow. T. J. Mattinen, pilot, and Charlie Foster, aircraft engineer, of Buchans, Newfoundland, converted a Seabee plane to the snowmobile pictured above. The 215-hp. Franklin engine drives a reversible-pitch prop that also serves as a brake.



Model Engine. You can tell the scale of this model Reeves traction engine from the pop bottle in front of it. The boiler is coal fired. Built by J. D. Penn, of Kokomo, Ind., who once used a big one for threshing, it closely follows its prototype in detail.

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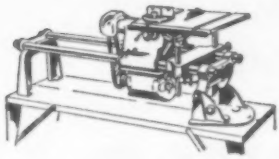
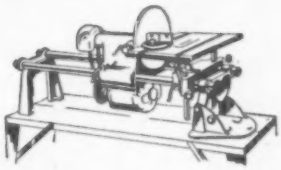


SHOPSMITH saw has capacity and performance equal to or greater than most cabinet shop models. Can cut to center of 8' plywood panels. Effective table width up to 56". Depth

of cut 2¼". Sturdy tilting table with ball-crank raiser for precise settings. Precision-tooled miter gauge and self-aligning rip fence.

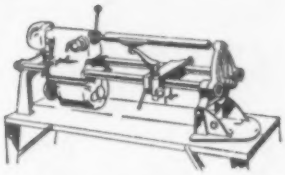
2. 12" DISC SANDER



With extendable quill, 12" cast-aluminum disc can be fed into workpiece for safety and accuracy. Extra-large adjustable table measures 14½" x 17". Use miter gauge for accurate

squaring and mitering; rip fence for super-smooth jointing; tilting table for compound-angle sanding. Operator can face work or work from side.

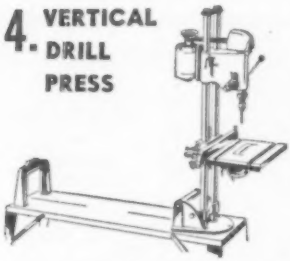
3. 33" WOOD LATHE



Greater capacity than most other heavy-duty lathes. 15" swing. 33" between centers. 4" quill feed. Swivel-arm tool rest always parallel to ways —no need for constant adjusting.

Quickly adaptable for face plate work. Fine-grain cast-iron headstock slides with fingertip pressure, locks in any position.

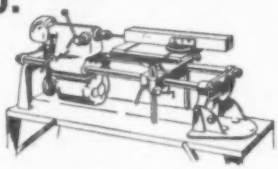
4. VERTICAL DRILL PRESS



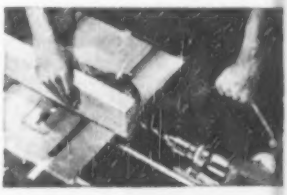
SHOPSMITH drills to center of 15" circle, has a maximum clearance table to chuck of 27", floor to chuck of 57". Jacobs key chuck takes straight shank drills from 5/64" to ½" diameter.

Rugged, 6-spline spindle floats on 4 lifelong, grease-sealed ball bearings. 4" quill feed. Lever fits either side of driving head for right- or left-hand operation. Speeds from 875 to 3500 rpm. Use with or without fence.

5. HORIZONTAL DRILL



Extremely useful operation possible only with SHOPSMITH. Quill feed up to 4" with adjustable stops. Permits large, heavy pieces to be drilled or mortised quickly, accurately. Handy,



too, for doweling tops for tables. Miter gauge and fence eliminate need for jigs. 36" effective table support. Length of work limited only by size of room.

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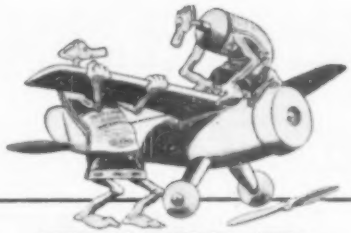

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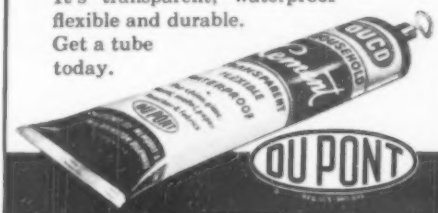

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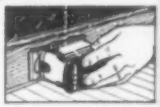

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Three sizes are available: 12¾" bench model, and 15" in bench or floor models. Send the coupon today. See all of the exclusive and special features of the Atlas before you select the drill press for your shop this year.

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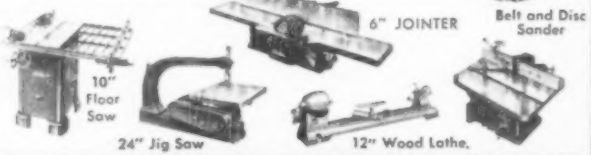
BIG in capacities — for any size job you want to undertake — BIG in value — with many unique performance and construction features — and built to industrial quality standards, these are the tools for commercial quality workmanship in your home shop. Use coupon for latest literature.



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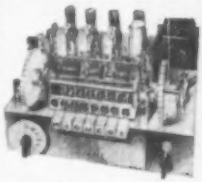

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4 or 6 Wheel Drive at a SAVINGS

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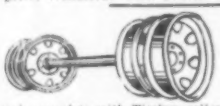

Heavy duty trailer axle suitable for many types of trailer construction. Also excellent for building of heavy farm trailers and wagons. It is a 12,000 lb. capacity square type straight trailer axle complete with Timken roller bearings, hubs, and 6 hole 750 x 20 Budd Wheels. Without brakes. Axle is 2 inches square and 69 inches between wheel mounting flanges. Std. width. Write for quantity prices, 6 or more.
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ELECTRIC **HOME-UTILITY** TOOLS

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12" BRAKE. Fits in vise to form difficult compound bends, up to 20 gage steel. **$12.50 PP.**
CUTTER. Cuts 18 gage steel any length and width. **$12.50 PP.**
SHEET METAL PLIERS. 2½" wide. **$2.00;** 5". **$3.00.**
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AIR or OIL HYDRAULICS

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ITEM #15—Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only . . . postpaid **12.95**

ITEM #17—Double action, 2⅜" bore, 8" stroke. (Will lift 4400 lbs. in one second with Logan Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A $65.00 value . . . postpaid **14.50**

ITEM #15—Double action, 3" bore, 8½" stroke. All steel hydraulic cylinder. (Will lift up to 7000 lbs. in 3 seconds with Logan Pump). Wt. 12 lbs. A $78.00 value . . . postpaid **19.50**

ITEM #31. Double action, 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Wt. 15 lbs. A $92.00 value . . . postpaid **22.50**

ITEM #42—Double action hydraulic cylinder. 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for . . . F.O.B. Chicago **32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.

115 Volt—60 Cycle A.C. LIGHT PLANT GENERATOR

(ITEM #67)

Ideal For: Home Lighting, Hunting Lodges, Stand-by Electricity. Running All AC Electrical Appliances including: Fans, Motors, Electric Razors, Refrigerators, Incubators, etc. 750 Watts at 1800 RPM using 1½ HP gasoline engine. 0-150 Voltmeter with Regulator. 1" diameter shaft with keyway for direct or belt drive, carried in two bearings, one bronze and one ball-thrust bearing, and packed separately to prevent damage to generator or shaft while in transit. Protection for emergencies to operate oil burner, stoker, freezer, water pump, and lights. These units, built to exacting Signal Corps specifications, are the answer to your lighting needs. Shipping wt. 60 lbs. AN OUTSTANDING VALUE **59.50** F.O.B. Chicago

HANNA Air Cylinder

Brand New

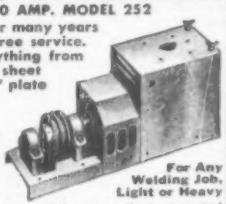
Used for heavy duty industrial applications on shop air lines or with low pressure systems. With 100 lbs. of air pressure, will deliver 1000 lbs. pressure at the ram shaft. All steel construction. Adjustable cushions at both ends of cylinder. Shaft dia. 1½". Foot mounting with clevis on ram shaft. 26½" double-acting stroke; 5" bore. 40½" overall length closed, 7" overall width. 89½ lbs. net wt. Gov't. acq. cost $101.85.

(ITEM #61) AN EXCELLENT VALUE for F.O.B. Chicago **39.50**

NOW . . . It's Easy to Weld with this handy ARC WELDER

250 AMP. MODEL 252

Designed for many years of trouble-free service. Handles anything from light gauge sheet metal to ½" plate



For Any Welding Job, Light or Heavy

(ITEM #65) This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it. The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc handles 1/16 to ½" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating—250 amps.; 0-30 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder. **F.O.B. Chicago** **99.50**

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. **(ITEM #66) F.O.B. Chicago** **10.50**

Remember, Satisfaction is Guaranteed

Gear Type—All Manganese Bronze Insecticide Pump

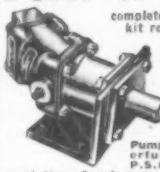
For Spraying D.D.T., 2,4-D, Sulphur Compounds, etc.

(ITEM #50)

BRAND NEW. Pressures up to 200 lbs. and 14 gallons per minute — at 1200 R.P.M. Will not rust, pit, foul or freeze up. Use rubber hose inlet, ¾" pipe outlet. Equipped with double mounting bracket. Weight 24 lbs. Dimen. 8"x7"x10". Standard 1" manganese bronze shaft with keyway.

U. S. Gov't. Acquisition Cost $62.00. NOW FREE—complete instructions and performance data with each pump. **15.00** F.O.B. Chicago

Vickers MF9 Hydraulic PUMP or MOTOR



complete with mounting kit ready to install

19.90 post-paid

$75.00 value

Pump is compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution. 8 gal. per min. at 3750 RPM. Change rotation by reversing flow. Delivers up to 6 H.P. Requires ¼ to 6 H.P. to drive directly or by pulley. BRAND NEW. Mounting kit has been especially designed to provide maximum utility and ease of mounting MF Series Vickers Pumps. Brackets are constructed of heavy steel plate; shaft is made of ½" steel with one end splined to fit pump other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

(Item #18) Pump only . . . . . **14.95** post paid

(Item #38) Mounting kit only . **4.95** post paid

Both as (Item #39) complete unit . **19.90** post paid

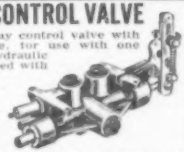
LOGAN HEAVY DUTY OIL Hydraulic Pump

BRAND NEW

. . . for operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 3 H.P. Has 1½" pipe thread inlet, ⅜" pipe thread outlet, ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7"Lx5½" Hx5½"W. A $105.00 value **22.50**

F.O.B. Chicago . . . FOR ONLY

HYDRAULIC CONTROL VALVE



ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship. wt. 8 lbs. A $8.00 value.

Postpaid . . **7.95**

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand new. Ship. wt. 6 lbs. A $60 value . . . postpaid **10.95**

ITEM #28. A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand new. Ship. wt. 8 lbs. A $75.00 value . . . postpaid **14.95**

LOGAN 4-Way Foot Operated AIR VALVE

Model 6520

BRAND NEW. For double-acting pneumatic devices. Fine for operating air vises, presses, air machinery of many types. Heavy cast construction. Threaded for ½" pipe. Dimensions of valve body 8½" L x 5¾" W x 7½" H. Net Wt. 28 lbs. Gov't acquisition cost $42.00. AN OUTSTANDING BUY AT . . .

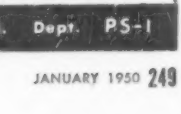
(ITEM #59) F.O.B. Chicago **15.00**

LOGAN HEAVY DUTY OIL Hydraulic Control Valve

(Item #37)

BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections. Overall dimen.: 12½"Hx8½"Dx 8"W. Ship. wt. 17 lbs. Govt. Acquisition Cost over $100.00. An Excellent Buy. F.O.B. Chicago **21.95**

WATEROUS PUMP



(Item #71)

Rated 500 gallons per minute at 120 P.S.I. This high efficiency pump is designed for front end mounting on General Motors, Dodge, Studebaker and Ford trucks and comes complete with gear box and power take-off for easy mounting and attachment to crank shaft. Net weight of pump 500 lbs. Shipping weight 1200 lbs. F.O.B. Chicago **149.50**

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PERFECT HOUSEHOLD SIZE

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Delta® Homecraft 8" Tilting-Arbor Saw

There's bigger capacity than ever in this husky new Delta Homecraft bench model with 11⅝ inches of table in front of the blade. Cross-cut and rip stock up to 2¼" thick, miter and bevel. The blade tilts 45° to the right. With accessories, you can dado and make mouldings.

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HM-75

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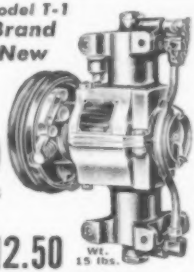
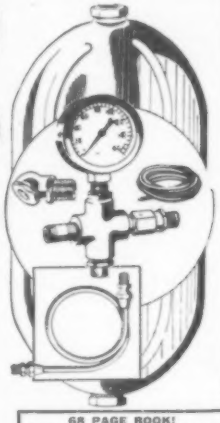
WESTINGHOUSE AIR COMPRESSOR

Model T-1 Brand New





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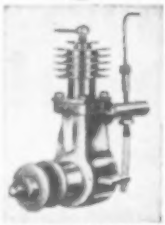

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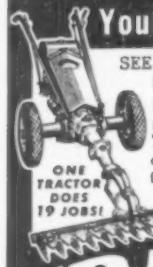

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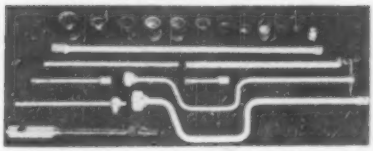

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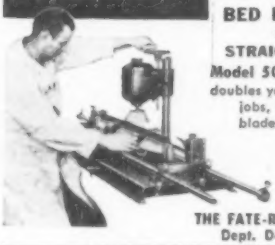

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8" Disc Wheel 1 1/8" Tire 1/2" sleeve	70c ea.
7" Disc Wheel 1" Tire 1/2" ball bearing	80c ea.
8" Disc Wheel 1 1/8" Tire 1/2" ball bearing	$1.00 ea.
8" Disc Wheel 2" semi-pneum. T. 1/2" B.B.	$1.35 ea.
10" Disc Wheel 1.75 semi-pneum. T. 1/2" B.B.	$1.50 ea.
Above wheel prices include hub cap.	
10" Aluminum Wheel 2 3/4" semi-pneum. T. 1/2" B.B.	$4.50 ea.

Plus Postage. 20% — C.O.D.'s accepted.

UNITED WHEEL STAMPING CO., PS-1
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NO SWEAT

KEEPS BASEMENT PIPES DRY

Just wrap "NO SWEAT" insulation around water pipes and seal with special Vapor Seal Elastic Tape. Pipes will stay dry even in hot, humid weather. Workshop and darkroom stay dry. Tools won't rust. Easy to apply. No fuss. No mess. No sticky tape. No tools required. Neat, clean, attractive installation. Send $1.00 for enough to protect 20 feet of 1/2" pipe. Full instructions included. We mail postpaid. MONEY BACK if you are not *completely satisfied.*

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WAR SURPLUS and OTHER ITEMS

Below are just a few of the thousands of items we have in stock at sensationally LOW prices.

Gas Engines	Extension Cords	Gear Head Motors
Pumps Grinders	V Pulleys Fire Pumps	Electric Hand Saws
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WRITE for our FREE bargain circular.

Special! Heat Booster

Fits any 8", 9", or 10" furnace pipe. 1500 RPM motor with 6" card-mounting frame, 7" blade. Motor can be oiled from outside. Easy to install. Silent operation. Warm those rooms with long run. Stock #583. Regular $9.95. Your price... **$5.95**

A Terrific Buy! GAS ENGINES

Briggs & Stratton NEW in original cartons. Both models with 2 groove V pulley 8 size 5 1/2 O.D.

MODEL	HP	LIST	Your Price
AP	1 1/2 to 2 1/2	$102	$49.00
ZZP	5 to 7	$141	$69.50

WRITE TODAY. HUNDREDS OF DOLLAR SALE BARGAINS.

C & H ELECTRIC Co.
438 W. JUNEAU AVE.
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Be Your Own Boss!

Another booming year is ahead in the building industry—and here's a double-barreled way for *you* to CASH IN!

Start your own business as a floor surfacing contractor with American Machines—and you will find hundreds of new and old homes are year 'round prospects for your services! No special schooling needed. No long waiting to get going in a business of your own. You can start sanding floors and make money as your own boss *the very first day* your machines arrive! Earnings of $25 and more a day are not uncommon among men like yourself who have become floormen.

You'll be proud to be a floor surfacing contractor and take your place alongside the plumber, the electrician, the painter and other building craftsmen as an important cog in the construction industry. In new construction you work as a sub-contractor and when resurfacing older homes you will usually operate as a separate businessman.

The investment in floor sanding equipment is small. The overhead is low and you need no elaborate offices, workshop, storeroom or heavy trucking equipment. Many men operate from their own homes and use a regular passenger car to transport their equipment from job to job. Pleasant indoor work . . . steady the year 'round . . . prospects everywhere . . . and *you are your own boss* . . . a real opportunity for a man with ambition to get ahead and MAKE MONEY!

Send for "money-making" booklet entitled "Opportunities in Floor Surfacing"—use coupon and enclose 25c in coin or stamps to cover handling.

AMERICAN
FLOOR MACHINES

SEND COUPON TODAY!

The American Floor Surfacing Machine Co., 532 So. St. Clair St., Toledo, Ohio,

Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing" telling me how I can start my own floor sanding business.

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OVER 500 WAR SURPLUS BARGAINS!

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Rubber soles, sheeplined for warmth. Zipper closure. Used, perfect. $18.50 val. $5.88

ALL SIZES Brand New $9.88

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Precision compass by "Sherrill" Easy to compensate, equipped with nite lite, excellent for planes, boats, trucks, cars, etc. Easily mounted. Instruction manual and calculator included. $25.00 value. $5.95

100% WOOL LINED Sportsmen's N-1 PANTS

$4.98

—100% Wool-lined, water-repellent jungle cloth! Rugged and warm! S.m., Med., lge. sizes.

ORDER NOW!

JACKET—SHEEPLINED TYPE AN-J4

Genuine Air Force issue! The Air Corp's finest jacket. Top grade leathers, trimmed at cuff and waist. Ex. lge. sheeplined collar. Adj. tabs at side, zip front. Reconditioned. $42.50 value. Med. sizes only.

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New! $21.95

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Finest 100% wool blankets issued! Soft, soil resistant nap. Olive drab, cleaned, guaranteed perfect. This quality in civilian colors sells for $12.50.

Wgt. 4 lbs. $3.88

BRAND NEW O. D. ARMY BLANKETS

Right out of orig. govt. cases. Size 68"x86". 4 lbs. $5.88 2 for 11.50

TYPE B-3A FLYING GLOVE

New, fine supple brown leather. Separate rayon liner for extra warmth. Sizes 8-9-10-11. Both complete.

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Mail orders add 10% for packing and shipping. Send deposit or check with order. Every item guaranteed as advertised.

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$10.00 wouldn't buy a better mitt. Warm, fleecelined, soft deerskin. New! Large only.

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FISLER SALES CO. 723 Walnut St. Kansas City 6, Mo.

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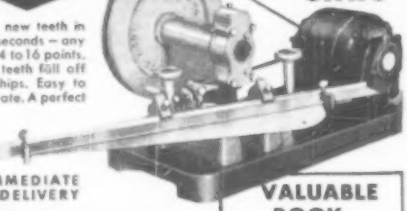
MAKES NEW PROFITS for HAND SAWS



Cuts new teeth in 50 seconds — any size 4 to 16 points. Old teeth fall off as chips. Easy to operate. A perfect job.

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Amazing new device for light sanding, polishing and body massaging ready! SYNCRO sands, polishes in tight places, corners, around mouldings and on flat, curved or irregular surfaces. Just guide it! Easily adjustable. 60 cycle, 110-120 volt AC. With 10 sheets sandpaper, fabric, lambswool pads, cord, plug, $14.50 at Dealers! If he hasn't, send $14.50 to factory, we'll ship Sander postpaid. See *other* Syncro products pages 270, 276. (Dealers write!)

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$8 EXTRA PROFITS! $8

Flocks & Sandblasts

Only $19.75 complete

Dual Purpose Spray Gun! Uses only 25 lbs. Air Pressure!

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ELASTO SPRAY GUN MFG.
Dept. PS-1, 7007 Hass Ave., Los Angeles 47, Calif.

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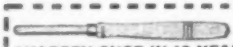

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These remarkable tools tipped with TUNGSTEN CARBIDE will astound you with their performance. They work FREE HAND equally well in wood, plastic or soft metals—and at the same time hold their razor-like edge almost indefinitely. Tests show that they will turn wood or plastic for days and days CONTINUOUSLY without showing any signs of dulling. They are the finest tools available at any price. Beautifully finished 5" blade—flush ground, polished tip—finest brass lube ferrule—9" hardwood handle—over all length 14"—25 tools to choose from: round and square nose from 1/8" to 1 1/2"—1/8" cut off; 1/2"x30° skew, spear, r. & l. skews, turning and parting. Amazingly Low Priced! Write at once for free literature.

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A power packed, super-sensitive one tube beginners kit includes miniature tube, factory wound loop antenna, plastic case and all parts with simple instructions. Works on pen-lite or hearing-aid cells. All parts, tube and batteries protected inside case. Astounding results. Poc-Kit Pal less phones and batteries only $3.98 post paid. SEND $1.00 balance COD plus fee. (FOREIGN $5.00 U. S. Cash).

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Homes $1885.00 and up, freight paid. Orders filled to order received. Save up to $1000 on modern production method on modern homes. Much more compared with builders' prices. Anyone can assemble with simple plans furnished. Complete including paint, hardware, roofing, glass, nails, etc. Send 25c in coin for full color catalogue showing 57 modern low-priced homes and floor plans, ready for building. Plans complete. Sold separately if desired. Dept. P.S. 150

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HAVE A PROFIT MAKING BUSINESS OF YOUR OWN

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Man or woman—young or old, YOU can earn a steady income in full or spare time as an independent Kendex dealer. Amazing and almost "impossible" earnings can become a reality for you. Herbert Armstrong of Tenn. earned $202 in 9 days. C. O. Watkins of Oregon sent 92 orders in one day. You have the same opportunity to duplicate these exceptional earnings. Over one million dollars will be earned in 1950 by Kendex dealers—why not let us establish you in your own business and get a share of these wonderful earnings?

KENDEX NYLONS REPLACED FREE . . .

if they run or snag within guarantee period up to three months! Impossible? It's true! No matter what the cause—hard use or deliberate abuse—whether it is fault of the hose or the wearer—Kendex nylons are replaced FREE if they run, snag or become unfit for wear within the guarantee period. How could any woman resist a positive guarantee of satisfaction when she can obtain it without paying any more than other standard advertised brands? Kendex nylons are NOT sold in stores, so you have no competition. Complete line includes everything from heavy 70 denier service weight to gossamer luxurious ultra sheer 15 denier 60 gauge. Proportioned sizes and lengths. Latest colors plus white.

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In addition to the sensational Kendex nylons, you will have a complete line of glamorous lingerie, beautiful robes and housecoats plus a complete line of Kentcraft mens' hosiery guaranteed for one full year. Any pair or pairs of men's hose that does not give satisfactory wear within one year of purchase will be replaced FREE!

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KENDEX COMPANY
BABYLON 549, N.Y.

Date _____ 1950

Send me, free and prepaid, everything I need to make money as a Kendex dealer, including sample stocking etc. There is nothing for me to pay now or later and I am under no obligation in accepting your money-making outfits.

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Address _____

City _____ State _____

WAR SURPLUS - U.S. SIGNAL CORPS

Genuine EE 8 Portable Telephones
Telephone Wire - Equipment

Big Annual Money-Saving **SALE**

ONCE AGAIN! BRAND NEW
Field Telephones Available
ea. brand new phone formerly **21.50** **NOW** only **17.50** ea.

Amazingly simple to install your own private telephone system with our portable telephones and wire. All you need do is string wire and attach phones to each end **and you are ready to ring and talk.** Add up to 6 phones on main line for dependable 2-way communication around **HOME, FARM, SHOP, CONSTRUCTION PROJECTS, FACTORIES,** etc. Powered by standard flashlight batteries. Ring and talk **up to 17 miles! Every phone checked for perfect operation and fully guaranteed.**

TELEPHONES **LIKE NEW.** Each phone thoroughly reconditioned like new.

Ea. phone **$12.95—SPECIAL:** 2 for **$24.50**
USED. recondit. Exc. Ea. **$9.95—SPECIAL:** 2 for **$18.50**
Reduced prices on all parts for Field Telephones. Write for Folder.

PRICES SLASHED **ON TELEPHONE WIRE FOR THIS SPECIAL SALE**

Prices specially reduced to **near wholesale cost.**
STOCK UP NOW AND SAVE. ORDER TODAY!

W110B Weather-proof, durable, 2-conductor, twisted telephone wire, insulated, stranded 7x.013, reinforced with steel strands for extra tensile strength (3 copper & 4 steel). **Many extra uses.**

Grade I unused, new, stored in open.

ONE-MILE REELS
Formerly **$27.50** MILE..... **SALE SPECIAL $21.00**

½ MILE REELS, formerly $14.25 ea. **SALE SPECIAL $11.00**
500 FOOT COILS, formerly $9.95..... **SALE SPECIAL $3.00**
1,000 FOOT COILS, formerly $7.25..... **SALE SPECIAL $5.75**

Grade II, unused, outer layer wire weathered but when removed inside layers perfect. Usability not impaired.

ONE MILE REELS
formerly **$27.50** mile..... **SALE SPECIAL $17.50**

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formerly $14.25 mile..... **SALE SPECIAL $9.00**

W130 **Lightweight Assault wire, 2-conductor.**

TWO MILE REELS, unused, **NEW** (10,500 ft. continuous) wt. only 85 lbs. A Real Special. Formerly **$57.50** reel. **SALE SPECIAL $37.50**

BRAND NEW ½ MILE REELS Wt. 16 lbs. Formerly $15. **SALE SPECIAL $12.95**

¼ MILE REELS slightly weathered, unused..... **$4.95**

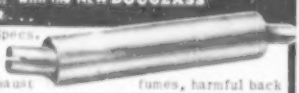
WRITE FOR FREE FOLDER—MANY OTHER SPECIALS!

All prices F.O.B. Sacramento. No C.O.D. California residents add 3% for sales tax. Small orders sent postage collect plus small handling charge.

SEND CHECK OR MONEY ORDER **LORIS SALES**

P. O. Box 1896-A Sacramento, California

SAVE YOUR ENGINE!! with the NEW DOUGLASS DUAL-TONE MUFFLER . . .



Engineered to the Specs. of every make car. Designed to eliminate dangerous exhaust fumes, harmful back pressure and to keep engines cool. Gives a rich, deep rumbling tone at the tail pipe. Steel Packed & Encased to give Extra Years of Service.

32-40 Ford V-8 $5.96 to 6.85 — 39-49 Merc. $6.85
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Order today...New — Racing & Hotrod CATALOG of special and speed accessories. Send 25¢ to cover hndlg. & mailing. Money refunded with first purchase. $2.00 Deposit on COD's.

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WOODWORKING PLANS

You don't have to be an expert to make your own furniture! These simplified instructions will show you how to make your own end tables, shelves, scrap hampers, etc.

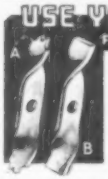
You also get a full size bottle of our famous "Gorilla Grip" Glue. Rogers has a ton of strength in every drop. It's great for making and repairing furniture.

Send 10c *Now* to Rogers Isinglass and Glue Co., Gloucester, Mass.

ROGERS
the best LIQUID FISH GLUE
GLOUCESTER, MASS.

USE YOUR BENCH SAW

FOR JOINTING & CUTTING MOULDINGS



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LEATHER FLYING HELMET

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Genuine NAVY aviators flying helmet. Cordovan brown leather. Warm—fleece lined. Brand new! Detachable chin strap. Perfect for cyclists, flyers, farmers, hunters, children and all-around outdoor wear. Best helmet service had. Govt. cost, $10.00. Sizes small, medium and large. Send check, cash, M.O. C.O.D.'s accepted. Money back guarantee. **$1.49** p.p.

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Another Speedcor Tool
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NEW REDUCED PRICE (Outfit No. 101, was $22.50)

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WITH *Infinitely VARIABLE SPEEDS, Clutch and INSTANT REVERSE*

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1½"-8 thread Lathe Chuck Adapter, $3 extra

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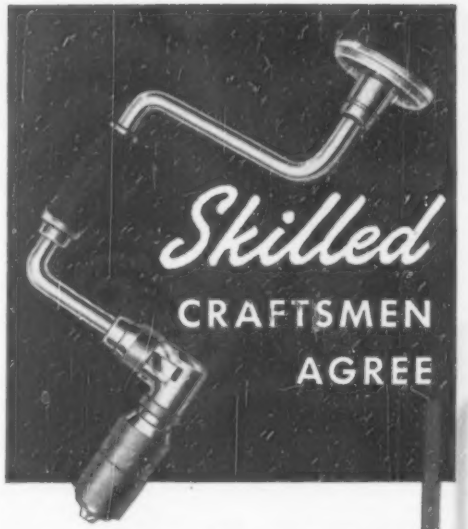

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Every field has its leader, and when it comes to bit braces, that means Millers Falls. For quality, performance and value, this famous line has been accepted for years as tops the world over.

There's a size and type that's right for every purpose and every pocketbook. Each is designed and built to give you the utmost for your dollar. Each incorporates the advanced features and superb workmanship that are a traditional part of all Millers Falls Tools.

Choose your next bit brace from the great Millers Falls line. It's on display at your hardware dealer's. Stop in and look it over. And remember, in bit braces, you can't beat Millers Falls.

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SINCE 1868

MILLERS FALLS COMPANY — GREENFIELD MASSACHUSETTS

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We Pay All Freight and Mail Charges.

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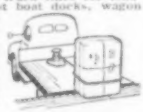
● Same engine with Utility Clutch $86.50

● **Winch—3,000 Lb.** 12" x 14", 9" high. New finest steel and bronze gears 80-to-1 power ratio. Useful for farmers, truckers, merchants, factories, etc. Used by leading truck lines for loading. Excellent for any hoist boat docks, wagon unloaders, etc. Drive with old car 6-volt starting motor, power take-off, fan pulley, etc. Easily mounted on tractors, trucks, docks, jeeps, etc. Pays for itself. Cost Gov't over $75. Sale Price **$24.95**



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● **ELECTRONIC EXPERIMENTAL JOB LOT.** Tubes, photo cells, thyratrons, resistors, capacitors, relays, switches. Guar. value ... **$4.99**

● **BARGAINS IN ELECTRICAL APPLIANCES, MOTORS, HOME WORKSHOP TOOLS, ETC.** Write for catalog.

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E. City Wall or Desk Phones	4.99
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FITS ANY ¼" ELECTRIC DRILL

"ARCO-SAW" is a rugged precision woodcutting tool with right angle gear drive. (No clumsy direct drive with drill sideways. Works like high priced Portable Saw. EXCLUSIVE SAFETY YOKE connects drill and saw. ABSOLUTELY SAFE TO USE. All Parts Guaranteed.

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5/32"	⅜"	Ball	15c
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5/16"	½"	Needle	15c
⅜"	⅞"	Ball	35c
½"	1¼"	Ball	40c
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Amazing high speed combination bit and saw fits any electric drill or drill press, takes place of up to $50 in tools. Drills own starting hole to cut, saw and ream an opening in the center of light metal, wood, plastic, etc. Easy to operate. Ideal for mechanics, electricians, plumbers, hobby workers, many others.

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This all-purpose, practical circular sharpening fixture is the ultimate in simplicity. Easiest, fastest sharpening method available. Precision built for precision sharpening.

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Send check or money order . . . money-back guarantee . . . nothing to lose . . . shipped prepaid with complete operating instructions.

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This newly invented **Four Way Portable Electric Welder** will amaze you by the work you can do on your very first job! Handles iron, steel, brass, bronze, aluminum and other metals with ease. **Works Instantly** on any convenient properly wired 110 volt A.C. or D.C. line. Does 1001 professional type repair jobs. **Saves Time and Money** on auto, home and farm appliance repairs. Ideal for maintenance and repair men, farmers, engineers, tinsmiths, home and auto owners, bicycles and fix-it shops. Satisfied users report success making money doing repair work for others, full and spare time. **Four-Way Welder** can be carried right to the job! Pays for itself over and over again! **Satisfaction or Money Back in 10 Days.** Order today with complete confidence. **Four-Way Welder** includes power unit and all supplies, ready to operate with simple instructions. **Fully Guaranteed. You Take No Risk.**

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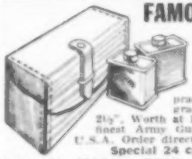
with 2 Cans Army Gun Oil **$1.00** comb. price postpaid in U.S.



This famous leather military case is ideal for Gadget Box, small tools, electric razor, first aid kit, fishing equipment, jewelry. Ladies purse. Dozens of practical uses. Made of finest top grade Cowhide. Size: 5½" x 3½" x 2½". Worth at least $5. Kit also contains two 2 oz. cans of finest Army Gun Oil. Combination price, $1, postpaid in U.S.A. Order direct from ad. Send check or postal note.

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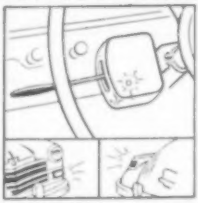

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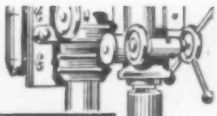
No more winter window cranking for arm signals. The new AUTO-TURN DIRECTION SIGNAL fits any car, **flashes parking and tail lights** 60-80 times a minute. No interference with regular lights, no extra lights to mount for most late cars. Smoothly operating, feather-light control lever. Works similar to factory installed models. All parts furnished—install it yourself. SPECIFY MAKE AND YEAR. For cars earlier than 1942, write for price. MONEY BACK GUARANTEE.

Durable, attractive chromium case. Also available in brown. $10.95, postpaid in U. S. Send check or money order. Postage extra on COD's.

The LESTER Company
Box S-1, 1743 North Milwaukee Avenue, Chicago 47, Illinois



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Converts any motor, drill press, electric drill, electric fan (10 inch or larger) into a handy rotary tool

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Attach ROTA-SHAFT in a jiffy. Use for grinding, polishing, sharpening, cleaning, engraving, making tools, carving on metal, plastic, wood, glass. Convenient handpiece for easy handling . . . **with 1/4 inch Adjustable Chuck.** 40-inch overall length. Complete with buff and sanding disc ready to use in a drill press chuck. Order today!

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With Your Drill Press and This LOW COST TOOL

Your drill press and this tool does all types of wood shaping—Routing, Tongue and Groove, Fluting, Notching, Inlay and any type of joint. Make window stiles, cabinets, doors, grooved sash, etc.

Complete with 3 blades

Complete with fence and platform to run professional work without slipping.

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SUPER DRILL GRINDER

Sharpens round shank drills from 3/32" to 1½" in diameter, up to 6" long. Grinds old drills like new in 4 different point angles, using hand or power grinding wheels. Money-back guarantee.

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At Dealers or Postpaid

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Kester Solder

SEND FOR NEW FREE Soldering Booklet

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New DURO saw with

High-priced features at lowest cost!

Sleek, rugged and streamlined, this new DURO 10" Band Saw is even **better** than it looks! It offers a host of features and advantages you'd **expect** to find only on models selling for many dollars more! Check these big DURO features:

BALL BEARING BLADE GUIDES—Patented, exclusive with Duro, these ball bearing blade guides above and below the table reduce friction heat and wear, keep the blade running truer, smoother.

HEAVY CAST IRON FRAME gives extra rigidity, vibrationless operation, increased accuracy.

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OTHER ADVANTAGES include rubber-tired disc wheels on needle type bearings, double trunnion table supports, separate tension knobs for blade adjustment, heavy cast iron table with extension tilts to 45°—and many others.

DURO 10" BAND SAW only **$49.95** less motor

See this new saw and others in the **complete** 1950 DURO Power Tool line at your dealers. Or, write for full details and specifications **today.**

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Gentlemen:
I am interested in your new low cost 10" Band Saw. Please rush me full details and specifications on it **plus** the brochure showing the complete 1950 line of DURO Power Tools.
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"Build Your Own" is shown above.

D.C. or A.C. arc welding is easy with newest HOBART welders. Simplified controls make welding easier, faster, better than ever. You can become expert in almost no time.

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D.C. Shop Welder

D.C. Generator

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Use margin for your name and address and mail TODAY to HOBART BROTHERS CO., Box P-10, Troy, Ohio.

Free! *Vest Pocket Guide. Useful data for all welders.*

HOBART welders

"One of the World's Largest Builders of Arc Welders"

Mortite KEEPS THE COLD OUT

SAVES FUEL AND MONEY

Cordlike and pliable, Mortite is the perfect weatherstripping. Goes on in a jiffy without tools or tacks. Keeps out wind, dust dirt. Anyone can press it around windows, doors, transoms, baseboards. Weatherstrip a whole window for 29c—costs even less if you use the larger package. Get Mortite at stores or write for circular. J. W. Mortell Co., 534 Burch St., Kankakee, Ill.

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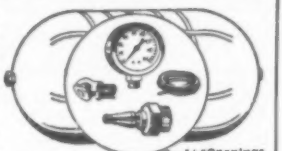
Air receiver, stainless steel, 12½"x24". 400 lb. test. Ideal for carrying on trucks, autos and wherever compressed air is needed. Equipped with 300 lb. air gauge, tire chuck, 3 ft. high-test air hose, air inflation valve with core for retaining pressure in tank, and fittings.

Complete outfit **$6.95**

Shipping wt. 20 lbs.

Same unit but with 6"x24" tank . . . **$5.95**



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SENSATIONAL NEW MODEL!

ONLY 11 pounds weight! One hand operation! Money-Back Guarantee of Superiority. Write for full details.

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World's largest maker of fine locators.

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Now Only $346.30 (Fed. tax paid, at factory)

9.5 hp. 4-cycle. 3-speed. Foot-shift. Over 70 miles per gal. Over 60 m.p.h. Write for free circular

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Don't shiver in a cold room. You can install this booster fan in the warm air furnace pipe yourself, and get forced circulation. Patented cooling feature prevents motor failure common to unventilated fans. Fits pipe sizes from 8" to 12", runs on house current. If your furnace dealer cannot supply you, write for free circular or send check to

$10.95 Delivered U.S.A.

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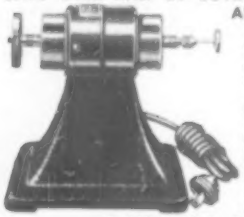
UNIVERSAL LATHE KIT $9.95

Thousands sold at $19.95 madeup.

SAVE OVER HALF BY BUYING THIS COMPLETE KIT AND PUTTING TOGETHER IN A FEW MINUTES



The finest small bench grinder made. 115 volts, 25 to 60 cycles, AC-DC. 1/20 H.P., 5000 R.P.M. complete with arbor and 3/32 chucks. Takes all standard tools. Yes everything you need including 6 feet wire and plug, weight 6 lbs. Send check or money order to Dept. L. Shipped by Exp.

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In your own workshop allows you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1½, 3 and 6 pounds weight, aluminum, copper, brass, etc., $22.50, $29.50, $42.00 f.o.b. Kansas City. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular.

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Start Small...Grow Big... with Success Equipment

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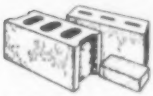

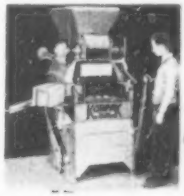

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MUFFLERS
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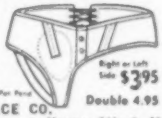
RUPTURE-EASER
FOR MEN, WOMEN AND CHILDREN

A strong, form fitting, washable support. Back lacing adjustable. Snaps up in front. Adjustable leg strap. Soft, flat groin pad. No steel or leather bands. Unexcelled for comfort. Also used as after-operation support. Give measure around the lowest part of the abdomen. Specify right or left side or double. We pay postage except on COD's



Right or Left Side $3.95 Per Pair
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10 different size HIGH SPEED STEEL Morse Taper Shank Drills up to 1". Over $40.00 worth of drills for only..... **$5.95**

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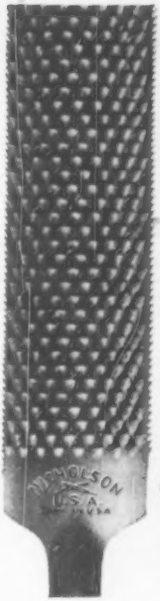
Drills from ½" to 1", extra long

1 Doz. Different Size HIGH SPEED HAND TAPS up to ½"..... **$2.00**

1 Doz. Different Size TAPER SHANK HIGH SPEED Reamers up to 1"..... **$4.50**

All sets are mixed new and used surplus and are sold with money back guarantee. POSTPAID

T&T TOOL 101 W. Archer Tulsa, Oklahoma



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12" CABINET RASP

EVEN hardwoods seem to melt away under the crisp, even bite of a Nicholson or Black Diamond Cabinet Rasp. More stock removal per stroke. More strokes for your money. Precisely punched teeth and expert hardening assure long-lasting sharpness. Half Round cross section.

You can get these top-quality rasps at any good hardware store. And while you're at it, look over your dealer's selection of *files for every purpose.*

FREE BOOK, "FILE FILOSOPHY"
—the "a, b, c" of file kinds, use and care . . . 48 interesting illustrated pages. Post-card request brings you your free copy.

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BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

NEW! JIG SAW FOR LAD AND DAD!

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3 IN 1 ELECTRIC MOTOR DRIVEN

JIG SAW... SANDER ...FILING MACHINE

- 10 DAY FREE TRIAL
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$12.00 POST PAID

Complete with 3 Blades, 3 Project Patterns and 2 Pieces of Wood

- Absolutely SAFE for Youngsters!
- Made of Light Weight Cast Aluminum!

6 IN 1 UTILITY SET

4 Screw Drivers & Hammer Combination $1 Post Paid

So handy for any job in the home in the hobby shop. GUARANTEED RUSTPROOF!

This Jig Saw has *everything* any hobby-minded "boy"—whether 6 or 60—could possibly want! Its A.C. 110 Volt electric motor (3000 revolutions per minute) has plenty of power for sawing—sanding—filing.

Versatile! Table tilts and rotates to cut at any angle—sanding table tilts through 45°—saw, which cuts to center of 16" circle, may be rotated to any position to cut longer lengths. Converts for filing by removing saw blade and arm and inserting ¼" diameter standard files.

USE HANDY ORDER COUPON

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4364 Elston Ave., Chicago, Ill.

☐ Enclosed find $12.00. (Check or money order in full.) Ship 3 in 1 Jig Saw-Sander-Filing Machine at once POST PAID.

☐ Enclosed find $2.00 as part payment. I will pay postman balance plus postage upon C. O. D. delivery.

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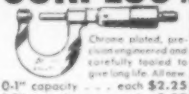
SURPLUS HIGH SPEED DRILLS MICROMETERS



Chrome plated, precision engineered and carefully tooled to give long life. All new.

0-1" capacity	each	$2.25
1-2" capacity	each	3.50
2-3" capacity	each	5.50
3-4" capacity	each	6.50

All New Drills! Fractional and numbered. Original value $15.00. Thirty assorted sizes and lengths..... $3.50

EXPANSION REAMERS

Spiral Flute. Made by Ansard Pink Tool Co. **All New.** original pack. 1/4" 3/8" 7/16". Recommended expansion limit, .006. Original value $12. Set of 3..... $4.95

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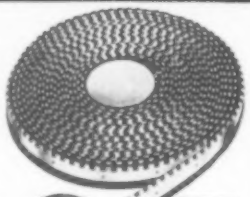
WEATHERPROOF YOUR HOME WITH *Nu-WAY* WEATHER STRIP

Easiest strip in the world to put on. Can be used on most any type door or window. Wool felt, reinforced with white metal.



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PALMGREN ROTARY, INDEX, MILLING TABLE No. 83

Has 8" table, 360° movement and 4" cross feed travel. Adjusting wheels and dials graduated in degrees and thousands. Slotted for bolting to table. **No. 83** Priced **$49.50. No. 82** without rotary feed **$39.75.**

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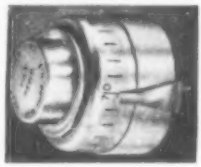
NOW—KEEP EACH ROOM AS WARM OR COOL AS YOU LIKE... *Automatically!*

Simply replace air valve on radiator with Heat-Timer valve and turn dial to temperature wanted. Heat-Timer acts as an individual thermostat for each room; no changes required in your present controls. Perfect for any one-pipe steam system; pays for itself in fuel savings. Precision made; lasts for years—50,000 satisfied users. At your dealer, or direct—only $4.95, prepaid; money back instantly if not delighted. Order today for every radiator. Heat-Timer Corp., Dept. U2, 160 Fifth Ave., New York 10.



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hold work through every step without a misstep

Any job locked in a "Yankee" Vise, is correctly positioned for every operation . . . hand or machine. Lifts on and off swivel base at bench. Machined accurately . . . top, bottom, sides and front end . . . V-grooved block for rounds. Four sizes, with and without swivel base . . . 1½", 2", 2¾" and 4" jaw widths. At your dealer's.

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YANKEE TOOLS NOW A PART OF STANLEY
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ARC WELDER

FOR HOME WORK SHOPS, MECHANICS, FARMERS, ETC.

For light welding. Repairs steel items 16 to 22 gauge, such as fenders, cabinets, troughs, toys, etc. No previous experience necessary. Complete unit only $5.95 Postpaid or C.O.D plus postage. Ten-day trial offer. Money back guarantee if not satisfied.

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$29.95

Send check or M.O. for immediate delivery. No COD's.

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REMOVE any finish

QUICKLY · EASILY

Anyone can do a professional removing job with Wonder-Paste Remover. Applied with a paint brush directly over the surface, Wonder-Paste reduces any finish to a butter-soft sludge that peels off quickly and cleanly.

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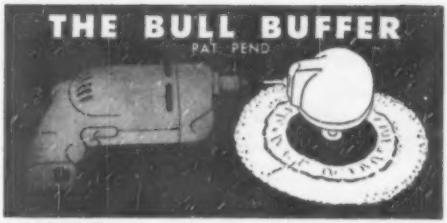
THE BULL BUFFER

PAT. PEND.



$9.95 Famous angle-head polisher-sander complete with sheepskin bonnet and 2 sanding discs. Fits the chuck of any ¼ inch electric drill. A heavy-duty, rugged tool you'll use to make your car, floors, woodwork, furniture gleam like new! It's America's First Choice—more than 100,000 in daily use. Order today!

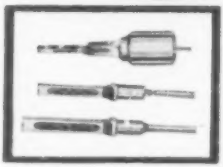
ORDER THESE ACCESSORIES FOR YOUR BULL BUFFER
(For use with Bull Buffer only)

5¾" finest quality bark tan sheepskin bonnet, **$1.25.** 5" aluminum oxide production sanding discs (0000-00-0-1-2½-3), **$.10** each. 2¾ open grit, **$.15** each.
½" Jacobs Hex key chuck. When attached to the Bull Buffer, gives you angle-head drilling attachment. Increases ¼" drill to ½" capacity, provides power for heavy drilling in wood or steel, **$5.00.**
2½" cup wire brush. Easily attached to Bull Buffer angle-head. Removes paint, rust, scale, etc. **Right now! $1.75.**

NEW! Just chuck it in your drill—and watch the chips fly!

Now you can mortise **on-the-job,** now you can rout **on-the-spot** with the new Bull Mortising Adapter! This amazing new adapter can be attached in either drill or drill press in a matter of seconds, and it gives you a powerful, **portable** tool that really makes the chips fly!

NOTE: Bull Mortising Adapter is designed specifically for use in any ¼" electric drill or any drill press; it should **not** be used with ⅜" or ½" electric drills.

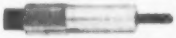


BULL MORTISING KIT

Includes Bull Mortising Adapter and ¼", ⅜", and ½" chisels with corresponding bits. Complete, guaranteed, only **$23.90**

MORTISING ADAPTER ONLY

Fits any ¼" electric drill or drill press; also fits any standard mortising bit and chisel **$6.95**



NEW AUTOMATIC SCREW DRIVER!

Now you can get to all those "tight places" and drive screws in **seconds** where it used to take **minutes** by hand! The new Bull Driver fits any electric drill, drill press or flexible shaft. **Automatically** centers on screw groove; **automatically** disengages when screw is firmly home in wood or metal. Three models—take your choice and order today! Any model **$4.95**

When ordering, specify model in either standard or Phillips.
MODEL A—Self-centering model for driving screws up to #14.
MODEL B—Self-centering model for driving small machine screws.
MODEL C—Without self-centering hood; long blade reaches those extra-deep counter-sunk jobs.

NEW PORTABLE DRUM SANDER

Uses Standard Sandpaper Sheets!

Now you can get to all those hard-to-reach places with the new Bull Drum Sander, a **portable** 2" drum sander that fits any electric drill (or drill press.) MOST ECONOMICAL drum sander on the market because you cut your own strips out of **ordinary sandpaper sheets** instead of buying costly sanding sleeves! No wedges or screws necessary; new patented feature lets you insert and remove sanding strips at the flick of a finger. Complete, with 6 sanding strips **$2.50**

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For prepaid shipment, send cash, check or M.O. to

BERTRUM B. ENGINEERING COMPANY
3121 Main Street DEALERS WRITE TODAY Kansas City, Mo.

BE YOUR OWN BOSS! Make UP TO $50.00 PER WEEK IN YOUR SPARE TIME

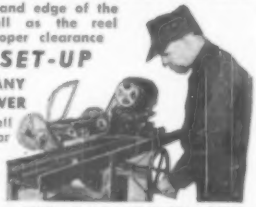
Mr. B. of California writes "The lawn mower grinding business, with my Universal Grinder, **has been a gold mine** these last two years." Mr. J. L. P. of Pennsylvania says "Thank you for getting me started in this wonderful business . . . I **averaged $100.00 per week** for the month of May."

ONLY ON THE UNIVERSAL LAWN MOWER GRINDER

. . . can the inside face and edge of the stationary blade, as well as the reel blades, be ground to proper clearance

ALL IN ONE SET-UP

WITHOUT REMOVING ANY BLADE FROM THE MOWER



Users who have tried them all acclaim the UNIVERSAL for above any grinder on the market. Write today for full details of our Proved Success Plan. It's Free.

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Please send me full details about the profit possibilities of Lawn Mower Sharpening.

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SYNCRO *hones* sharp hundreds of articles in homes, shops, farms. First and only ALL-PURPOSE hone that m-o-v-e-s electrically! 14,400 rapid, gentle safe strokes a minute! No belts, wheels, gears. 60 cycle, 110-120 volt AC. *Both* hands free to hold work. Easily adjustable. Ideal birthday, personal gift. With 3 interchangeable Honing Stones, Cord, Plug, $10.50 at DEALERS. If he hasn't, send $10.50 direct to us, we'll ship Sharpener postpaid. Satisfaction Guaranteed. See *other* Syncro products, pages 258, 276, this issue! (DEALERS WRITE!)

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with DI-ACRO SHEAR

Many small parts can be rapidly duplicated without dies, to accuracy of .001" with DI-ACRO "Die-Less Duplicating" Machines,—Benders, Brakes, Shears, Rod Partners, Notchers, Punches. Save die expense and time delay. For experimental work, samples, models, etc., as well as regular production runs. Write for "Die-Less Duplicating" circular.

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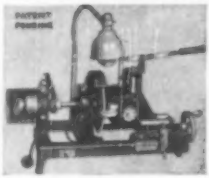

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Please send remittance with order. Include postage. Guaranteed satisfaction. You are privileged to return an unsatisfactory purchase for refund

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PANTS 28 TO 32 — **2.66**
Used, reg. reissue perfect condition 100% wool serge. Cleaned & pressed by Q.M. Corp. Add 12c ea. post

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Genuine 8.2 chino khaki suntan material. Pants with cuffs. Add 11c post. per garment.

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3/16" dia. white or khaki. 550 lb. ten. strength. For clotheslines, venetian blind and drapery cords and other uses. Add 4c post

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17 JEWEL Military Style WRIST WATCH
BRAND NEW
GEN. INCABLOC
WATERPROOF
SHOCKPROOF
Non-magnetic, radium dial, sweep second hand. St. steel case. Complete with leather strap. Guaranteed Swiss 17-Jewel movement. A truly remarkable value. Add 15c post
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OUR BETTER QUALITY 2.55

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BRAND NEW ARMY AIR FORCE ASTROGRAPHS with case
New B-29 navigation instrument which can easily be used to make a good contact printer, strip map holder, etc. The plywood case 14½" x 11" x 10" high is perfect as tool kit, camera projector case or for building a portable phonograph, picnic kit, makeup case, etc. Has leather handle, reinforced cover, eight covered compartments in bottom. Cost Gov't $125.00. Add postage for 20 lbs.

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Use on car, boat, dark rooms, workshop, airplanes, etc. Turn of knob gives clear, white, or red light, also pulls out 6 ft. on spring wound internal reel. Quick snap automatically rewinds wire. Fluorescent tipped on-off switch. Takes standard automobile bulb — mounts anywhere. 3" x 3¼" x 4¼". $12.50 value only. FOB B. H. **$2.50**

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These "Brand New" Double Action, Precision Hydraulic Cylinders have 1000's of applications for use on lifts, presses, actuators, positioners, etc. Use with either air or oil. All use standard pipe fittings.
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Modernize your car. Fine for desk ornament. Shows height above sea level up to 20,000 feet while driving your car, same instrument as used in airplanes. Front adjustment knob sets instrument for your location. Fluorescent Dial glows at night — easily installed — no connections — self-contained — Measures 3¼" x 3¼" x 3". Certified calibration chart included — suitable as a laboratory standard instrument. Cost Gov't many times this price.
FOB B.H. **$3.50**

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You've Always Wanted

7 saws in 1
RIP, CROSSCUT, KEY-HOLE, COPING, SCROLL, BAND OR JIG

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Every home craftsman will find Whiz-Saw useful for both rough cutting jobs as well as precision work. Light in weight but amazingly sturdy, Whiz-Saw cuts wood, bone, plastic, fibre board, pressed wood, hard rubber, etc. up to 1" in thickness. Whiz-Saw is the only saw made that will make inside cuts without first boring a starting hole. And, when clamped to the Whiz-Saw table, precise band or jig saw work is easy. *Send for free booklet.* Visit your dealer or order direct. Send check or money order to The Forsberg Mfg. Co., 125 Seaview Ave., Bridgeport, Conn., U. S. A.

WHIZ SAW $49.00 Table $18.95

the ideal cutting tool for:
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Makers of the Famous Whalo & Viking Tools

MODERN LAWN MOWER SHARPENER

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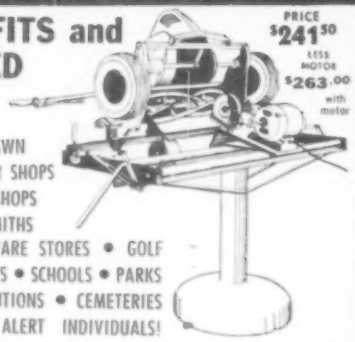

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700x15	5.29	650x16 (6)	6.95	750x20 (8)	10.68	1000x20	15.96
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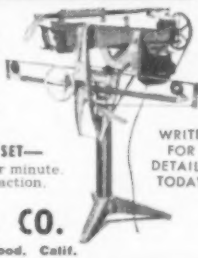

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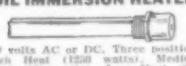

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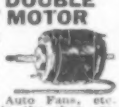

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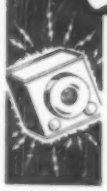

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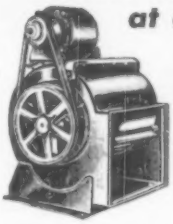

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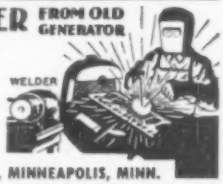

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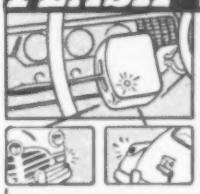

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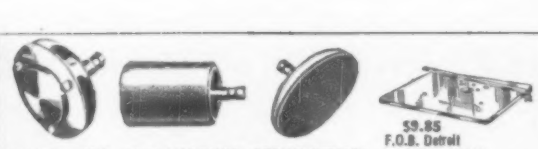

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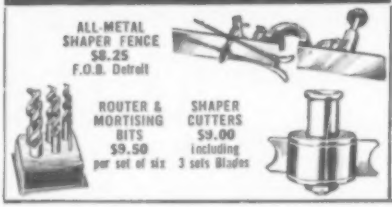

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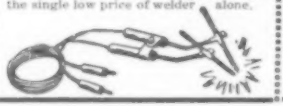

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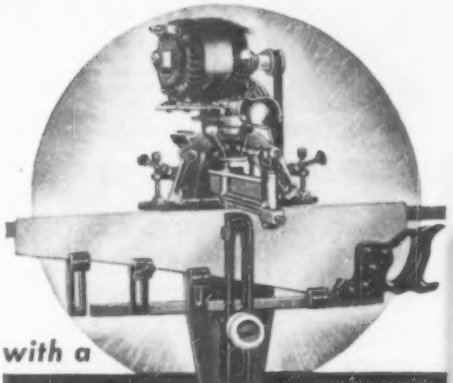

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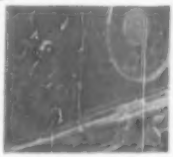

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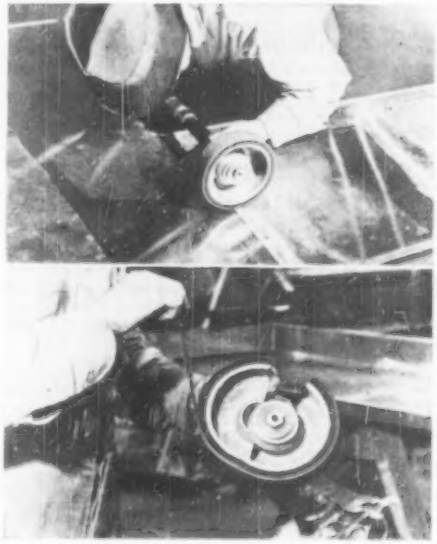
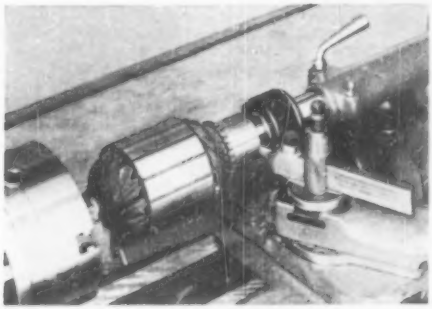


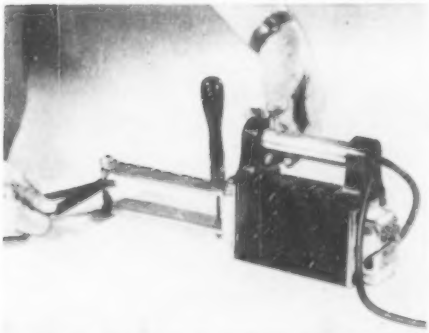
Sander Has Split Drum. Made by the American Diamond Saw Co., Portland, Ore., this sander has a split drum that's cushioned with rubber. The halves of the drum are locked together by a cone-type washer. Standard abrasive strips in roll form are used. They're secured by pins that recede out of the way when tightened.

Thread - MeasuringTool. Made by W. T. Simmons, Amarillo, Texas, this tool uses a connected pair of hardened, triangular steel bars for the micrometer surfaces. The manufacturer says measurements can be made faster and more easily than by the conventional three-wire method. It measures all standard or 60° threads, from four to 56 pitch. No formula is needed. Use of a chart furnished with each set and simple addition work out all computations.

Tools



Supports Centerless Shafts. This adjustable, collet-type tailstock chuck centers and supports centerless shafts in a lathe. Made by the South Bend Lathe Works, the tool takes shafts from ¼″ to 1″ in diameter. Brass collet chucks can be supplied for round stock in sizes from ¼″ to 1″ by 16ths. A special collet is available for chucking popular types of automobile generator armatures.



Portable Spot Welder. The 14½-lb. Welderon®, handy for repair and replacement work as well as new jobs, can be plugged into any 115-volt, 60-cycle, 25-amp. outlet. It's priced at about $79 by the Welderon Co., of Providence, R. I. It has three current taps for spot-welding metals up to a combined thickness of ⅛″. Exposed metal parts are chromium-plated. Over-all length is 17¾″, width 3″, and height 8½″.

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- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34″ high table always stays level
- New Departure ball bearing arbor, ¾″ precision shaft turned down for ⅝″ bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) $20.95
Same Kit with 10″ Combination Blade $24.90
Same Kit with 8″ Combination Blade $23.90

GIL-BILT 8-INCH TILTING TABLE SAW

- 21x27 in. table tilts full 45 degrees, 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ in.
- New Departure ball bearing arbor, ¾″ precision shaft turned down for ½″ bore blades, alum. housing, ready to run
- Cast aluminum miter gauge and self-align. rip fence guide (same as above)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments, and All other Metal Parts (less blade) $15.95
Same Kit with 8″ combination blade $18.90

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings. Upper wheel runs on two ⅝″ bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs
- Uses standard 78 inch blades up to ⅝ inch wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, 14 inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts $16.95
Same Kit with two machined ready-to-install 12″ cast aluminum wheels $20.95

NO DEALERS—One Low Factory Price!

Return in 10 days for full refund if not satisfied. Prices include postage within 600 miles. Over 600 miles add 5%. Send cash, check, or money order for parts kit, or send $1.00 for Step-by-Step Plans and order kit later less cost of Plans. Plans sent postpaid anywhere in the world.

COMPLETE PLANS only $1.00 EACH

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EXPERTS USE!

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Space-Saving Hardwood Rack Hangs Up Where You Work

40 PIECES—1001 PRACTICAL USES!

IT'S THE TOOL THAT drills . . carves . . sands . . saws . . sharpens . . buffs . . cuts . . polishes . . grinds . . . for WOOD . . METAL . . GLASS . . LEATHER . . PLASTICS.

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THINK OF IT! A master tool that master workmen use. Now, no home job too difficult! This Casco super-speed power tool with Casco's new solid hardwood rack puts workshop perfection at your finger tips . . . Yours to use on a thousand different jobs. Every tool ready for instant use. Precision-built fractional HP motor, AC-DC. Exclusive Casco pencil-grip. Radio static-suppressor! Valuable free 36-page Project Book!

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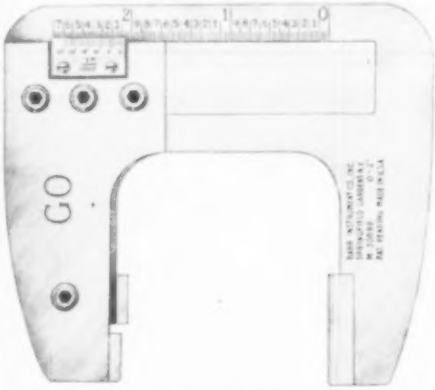
CASCO Products Corp. Bridgeport 2, Conn.

New Tools



Gauge Has Wide Range. The Barr Instrument Co., Inc., Springfield Gardens, N. Y., makes this wide-range snap gauge in six sizes, giving a range up to 6″ with readings in .001″. To set the gauge, you move the no-go member to the desired vernier reading. Next the go member is moved to the acceptable tolerance. Then the three hollow-head screws are tightened and the gauge is set for the maximum and minimum limits. The frame is made of alloy steel, and the hardened anvils are ⅜″ wide.

Metal Grinder. This surfacing machine consists of a table and a fence against which the work is moved. A cup stone, driven by a movable motor, protrudes very slightly through the opening in the fence. After the stone is dressed flush with a diamond dresser, it's brought through the fence .0015″. The maker is the Phoenix Pattern and Mfg. Co., Phoenix, Ariz.

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TUBE DELIVERED WITH TIRE AT NO EXTRA COST For 15" or 16" Passenger Tires

Safe—Our tires used on school buses and ambulances

EXCEPTIONALLY GOOD TREAD—NO RECAPS

600-16	6 ply Military—Mud and Snow Tire		$6.37	600-20	$ 9.75		
550-16	$5.19	550-15	$4.81	825-20	$15.98	650-20	9.75
600-16	5.29	525-18	6.69	900-20	15.98	750-20(10)	15.98
650-16	5.29	550-17	7.99	1000-20	16.89	32-6(8)	10.49
700-16	6.29	650-15	4.98	700-15	5.29	32-6(10)	13.75

ALL GOOD TIRES

550-16	$3.54	600-20	$7.98	825-20	$11.19	1000-22	$17.70
600-16	3.59	30-5	7.98	900-20	11.89	1100-22	16.89
650-16	3.89	650-20	7.69	1000-20	12.89	900-24	
550-15	3.79	700-20 (8)	9.29	1100-20	13.89	(40-8)	21.60
650-15	3.89	700-20		1200-20	18.78	900-16	8.98
700-15	3.98	(10)	12.48	750-24		825-15	
550-17	5.69	750-20 (8)	8.19	(36-6)	12.21	(14 ply)	14.10
750-16	8.40	750-20		38-7		750-15	
		(10)	9.19	(825-24)	13.75	(12 ply)	11.30

GOLD BOND SPECIAL—750-20 MILITARY TIRES

Will fit 650 x 20 700 x 20 (8 & 10 ply) 34 x 7 (8 & 10 ply)

Special $10.49
Superior Quality $12.98
Gold Bond Finest $14.98

900 x 16 SPECIAL $9.03 900 x 16 EXTRA $11.19

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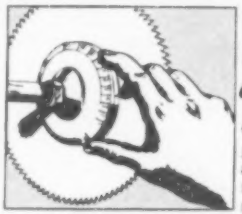
"A gold bond written guarantee with every tire"

Better, Easier, Quicker GROOVE CUTTING or CABINET-MAKING with Warren DADO SAWING WASHERS



Just dial DESIRED CUT

Cut accurate, parallel grooves—any width, any angle. Just dial desired width with Micromatic adjustment. Cuts smooth and clean—no burning or chewing to mar fine wood. Just four simple washers—can be left on blade for straight cuts to strengthen blade. Available in 5 sizes —½", ¾", ⅝", 1", 1⅛". See your dealer or send for free booklet. Absolutely guaranteed!

$4.95 A SET

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WARREN DADO SAWING WASHERS CO.
70 Medbury, Dept. 41 Detroit 2, Michigan

P.S. Last minute news & notes...

ODORLESS PAINT--something many home decorators have wanted--has been put on market by Keystone Paint Co., Brooklyn. It contains a highly refined petroleum thinner instead of turpentine. Oily binder also has been deodorized.

YOUR BLOOD can be tested for diabetes, anemia, syphilis, RH factor, and type in a trailer built for the U.S. Public Health Service. This new laboratory on wheels makes multiple tests from a single sample and mails results to the family physicians of its visitors.

AUTOMOBILES operating in areas where the temperature frequently drops below -10° F. require extra-light crankcase oil. A committee of the Society of Automotive Engineers has now approved 5-W oil for such use. Previously 10-W oil diluted with 10% kerosene has been recommended.

MORE CURRENT can be put through motors and transformers insulated with new forms of Teflon, a plastic developed by Du Pont. Output of one large motor was increased 40% this way.

GAS METERS like the ones in houses have acquired two new jobs. Texas Co.'s oil research lab uses them to detect stuck piston rings in engines by measuring combustion gases leaking into the crankcase. And Dr. Charles Lester, of New York's Roosevelt Hospital, uses them to measure oxygen absorption in the human engine by metering lung intake and output.

TOUGH TOPS for convertibles are being made of cloth woven of Fiberglas yarn coated with vinyl. Owens-Corning says they don't stretch out of shape and will last three to four years.

NEW A-BOMB STUDY estimates that four-fifths of occupants of AEC building in Washington would be casualties if bomb went off 1800 feet overhead. "Adequate warning must be assumed for any shelter to be effective," report emphasizes. "Hence, dispersal is far preferable."

MEDICINES & SURGICAL supplies that are hurt by heat can now be sterilized by spraying with deep-penetrating cathode rays--after being sealed in glass containers. M.I.T. researchers report the treatment kills all bacteria and viruses but raises the temperature less than eight degrees.

The Editors

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DON'T pay several hundred dollars more than necessary when you build a home! Buy direct from our mill at our low factory price. We ship you the lumber cut-to-fit, ready to erect. Paint, glass, hardware, nails, etc., all included in the price—no extra charges. Plans furnished—also complete building instructions. No wonder our customers write us that we saved them 30% to 40%. Easy terms—monthly payments.

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Give Your Car this Tonic— Add Power, Pep and Performance

MARVEL INVERSE OILER

Here's the famous, low cost, auxiliary lubricating system that meters MARVEL MYSTERY OIL to critical upper cylinder engine parts, precisely in accordance with engine load. The compact INVERSE OILER functions inversely to manifold vacuum, retarding feed *visibly* when throttle is closed or at engine idle, an exclusive MARVEL feature! You can keep ring, piston and valve wear down and performance way UP this winter with the sensational MARVEL INVERSE OILER.

Learn about MARVEL MYSTERY OIL too—the famous oil improving Additive for YOUR motor oil that produces a slow idle, faster engine pick-up and an even, power pull. Thousands of car owners are using it in increased volume this winter for engine protection and to keep starts summer quick in cold weather and in ALL gear greases—it flows at 70° below zero!

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The MARVEL INVERSE OILER *Is Easily Installed on Most Engines*

EMEROL MANUFACTURING COMPANY, INC.
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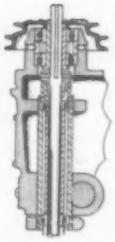
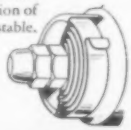
FOUR PRECISION BALL BEARINGS

Two on spindle, two on drive sleeve. Pre-lubricated and sealed precision type, no oiling required.



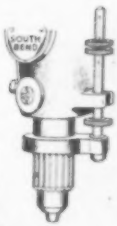
ADJUSTABLE QUILL RETURN SPRING

Retracts quill instantly upon release of feed lever. Tension of spring adjustable.



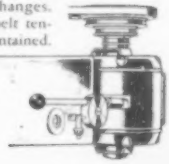
DEPTH GAUGE

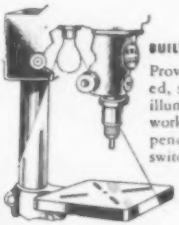
Controls feed depth, length of return stroke, or locks spindle in any position. 16th graduations.



BELT TENSION RELEASE

Flip of lever removes tension from belt for easy speed changes. Proper belt tension maintained.



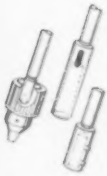


BUILT-IN LIGHT

Provides shielded, shadowless illumination on work area. Independent on-off switch is built-in.

NEW!

SOUTH BEND 14" Drill Press



INTERCHANGEABLE SPINDLES

Spindles available to take No. 2 Morse taper shank tools, and for 1/2" straight shank tools, router bits, shaper cutters, etc.

TABLE LOCK

Double-plug binder securely locks table to column. Eliminates misalignment Column bearing is NOT split.

FREE-FLOATING SPINDLE

Design prevents misalignment, side thrust and whip. Precision splines in spindle and sleeve.

QUILL BEARING ADJUSTMENT

Shoe-type take-up provides feather-touch tension and secure locking. Quill bearing is NOT split.

CAPACITIES — SPECIFICATIONS

CAPACITY
Maximum drill size in iron or steel—½". Drills to center of 14¼" circle.

CHUCK
Capacity—0 to ½"

SPINDLE
Regular drill chuck type supplied.
Travel . . . . . 4"

CHUCK TO BASE DISTANCE
Bench Model—17"
Floor Model—46½"

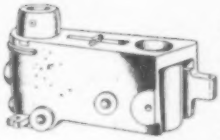
SPINDLE SPEEDS
Four—655 to 4530 r.p.m.

TABLE SIZE
10" x 10". Tilts to any angle.

Bench Model $129.30

Floor Model $144.30

Prices, f.o.b. factory, include drill chuck and 1/3 h.p., 115 or 230 v., 1 ph., 60 cycle motor and switch.



ONE-PIECE HEAD CASTING

Insures perfect alignment. Double-plug binder locks the head to column. Column bearing is NOT split.

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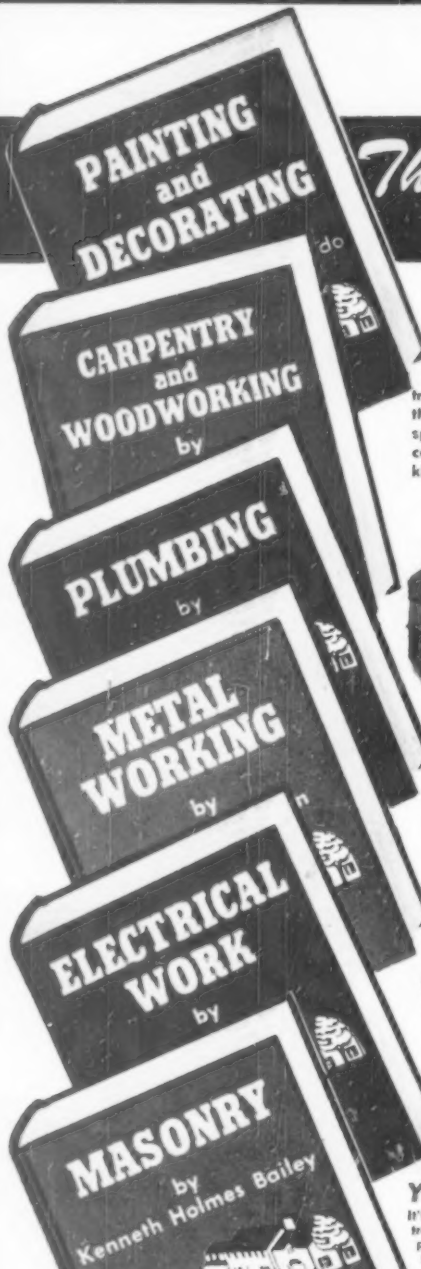

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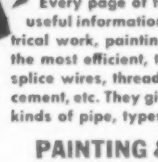
PAINTING & DECORATING

This great book gives complete color-schemes for every room in the house. Contains tables and formulas for obtaining any desired hue. There are full directions for the selection and care of brushes and other equipment. How to calculate amount of paint required, and best methods of applying to wood, metal, brick, concrete, stone, stucco, plaster. Exterior house painting—interior house painting. Methods of finishing with stain, shellac, varnish and wax. Proper stains for each variety of wood. How to refinish an auto quickly, easily, inexpensively. The section on wall papering is especially complete and detailed—how to size the wall before applying paste, how to hang the paper smoothly, etc.



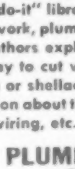
Practical illustrations show you how to beautify your home, inside and out. How to select colors and mix paints, etc.

ELECTRICAL WORK

Here is practical information about every electrical job around the home. Principles of electricity. Tools, materials, and requirements of National Electrical Code. Complete, fully illustrated explanations of every step in various operations of general electrical work—splicing, soldering, taping, testing, etc. Installation of various signalling systems—bells, buzzers, and alarms. Wiring methods for power and lighting circuits. Complete projects such as BX wiring a room, and wiring a garage in conduit are made clear by diagram and photographs. Also, there are instructions for adjusting oil burners, refrigerators, pumps, etc.

Cut-away views make it easy to repair all household appliances.

PLUM



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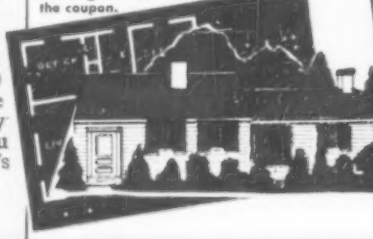

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Hands-at-work photographs show you exactly how to install, repair and insulate pipes, fittings, etc.

s complete volume answers every stion about the repair, the cleaning the maintenance of the entire plumb- system. The various kinds of pipe, fittings, valves, and fixtures are de- bed in detail. There is full information ut all common plumbing tools. How ut, ream, thread, and assemble iron brass pipe. How to connect copper ing and make lead joints. The tech- ue of pipe fitting, and the proper se- nce of steps in assembling a piping tem. There are complete details about alling a hot-water heater, radiator various other units, and instructions fixing leaks in faucets and valves, re- ring a faulty section of pipe, etc.

MASONRY

Every practical fact about concrete, plastering, stucco, brick work, concrete-block and glass-block construction is made clear in this handbook. Every repair or new-construction project described can be accomplished by a man who never before has done masonry work. It describes all tools, and explains just how to use them. How to specify materials and estimate quantities. How to build forms; mix concrete, color it, make it watertight. Material charts. Types of construction. Various bonds. Working with concrete blocks. Kinds and sizes of glass blocks. Glass-block construction—full-mortar joints, set-in-wood construction, etc. All facts in this great volume are fully and clearly explained.

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This exceptionally interesting volume describes the many varieties of wood and their relative merits, working qualities, and uses. Plywoods, veneers, and wood substitutes—how to choose the materials best suited for the job. All the basic operations and processes of woodworking—everything from how to avoid warping to full directions for cutting each of the common joints. Wood turning—the different cuts, roughing, facing, sanding, and finishing; drilling, boring, morticing, spinning, polishing. Hundreds of repair jobs and new-construction projects are fully explained.

Making tables, chairs, book cases, etc., is great fun and a real money-saver. Step-by-step pictures show you every move in the use of tools and materials.

METAL WORKING

Here you will find complete information about all the common metals and the alloys—wrought iron, cast iron, steel, German silver, pewter, the brasses and bronzes, solders and Babbitts. For each of these there is given the most complete information about working qualities and uses, sizes and shapes obtainable, color, weight, identification, resistance to corrosion, and every other detail you need to select the best material for your purpose. Hand tools and machine tools—their specific purposes, sizes, and the most detailed instructions for their use. How to use the engine lathe. Included are metal jobs and projects for home and shop, complete with bill of material, equipment needed, and a fully illustrated account of every step in the work.

Simple directions and "tricks of the trade" make repairs to roofs, gutters, downspouts, etc., easy, inexpensive.

Pop. Sci.—Jan. '50

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- Fix leaks in faucets and valves
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- Install a hot-water heater
- Make a flagstone walk, a sidewalk, concrete steps
- Tighten a loose chair, floor board or stair tread
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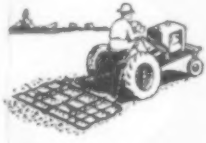

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